VOLATILE OIL COMPOSITION OF *CENTAUREA AUCHERI* (DC.) WAGENITZ.

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ABSTRACT

Centaurea aucheri (DC.) Wagenitz is one of the species of Asteraceae that has not been the subject of many investigations. Different species of this genus have been used in traditional medicine. In this investigation C. *aucheri* was collected from Khanesorkh of Kerman and the essential oil of the aerial parts of plant was extracted by Clevenger apparatus and analyzed by GC-MS. Identification of the components of oils were based on their retention indices and mass spectra data in comparison with those reported in literatures. The amount of essential oil was 0.16% and 22 substances consisting 80.03% of the composition of the essential oil were identified. The main compounds were caryophyllene oxide (19.44%), β-caryophyllene (14%), Geremacrene-D (13.38%). The essential oil was rich in sesquiterpene oil.

Keywords: *Centaurea aucheri*, Essential oil, GC- MS

INTRODUCTION

The large genus *Centaurea* (Asteraceae, Cardueae) comprises about 500 species, which are predominantly distributed around the Mediterranean area and in west Asia (1). In Iran this genus has 74 annual to perennial herbaceous species that are widespread around the country (2). Some species of *Centaurea* genus such as *C. cyanus* and *C. scabosia* have anti-pyretic, analgesic, cardiotonic activities and are useful for liver and skin diseases and relif of thestomach-ache (3, 4). *Centaurea aucheri* (DC.) Wagenitz is a perennial herb that approximately grows all over of the country (5). A literature search showed that no report on the analysis of secondary metabolites of this plant is available.

Studies on the volatile constituents are limited to *C. cineraria* subsp. *umbrosa* and *C. napifolia* (6), *C. mucronifera* and *C. chrysantha* (7), *C. pseudoscabiosa* subsp. *pseudoscabiosa* and *C. hadimensis* (8) and *C. kotschyi* var. *kotschyi* and *C. kotschyi* var. *decumbens* from Turkey(9), *C. pelia*, *C. thessala* subsp. *drakiensis*, *C. zuccariniana*, *C. raphanina* subsp. *mixta*, *C. spruneri* from Greece (1,10) and *C. calcitrapa* and *C. solstitialis* from the USA (11,12,13). Other studies deal only with partially characterized essential oils of *C. calcitrapa*, *C. gloriosa* and *C. moschata* (13-16).

Secondary metabolites which have been isolated from *Centaurea* species are: flavonoids, nor-isopernoides, elemanolides, elemanes, germa-crenolides and eudesmanolides (16-19), flavonoid sulfate (20), sesquiterpene lactones (21, 22) and Indole alkaloids (23).

This investigation describes the volatile oil constituents of *Centaurea aucheri* (DC.) Wagenitz. from Iran.

MATERIALS AND METHODES

Plant Material

The aerial parts of the wild-growing *C. aucheri* (DC.) Wagenitz. were collected during the flowering period from Khanesorkh, (Kerman Province, Iran) at an altitude of ca. 2500m in June 2002. The plant was identified as *C. aucheri* (DC.) Wagenitz. by Dr. Vahideh Nazeri in Bahonar university of Kerman and a voucher specimen of the plant (No. 1024) was deposited in the Herbarium of the Faculty of Pharmacy of Kerman university. The air-dried aerial parts of the plant were powdered and the volatile fraction was prepared by hydrodistillation (Clevenger) for 3 hours and then it was dehydrated with anhydrous sodium sulfate for GC-MS analysis (24).

GC/MS analysis

The oil was analyzed by GC/MS using a Hewlett Packard 6890 mass selective detector coupled to a Hewlett Packard 6890 gas chromatograph, equipped with a cross-linked 5% PH-ME siloxane HP_5-MS capillary column (30 m × 0.25 mm, film thickness of 0.25 μm). Operating conditions were as follows: carrier gas, helium with a flow rate of 2 ml/min; column temperature, 60-275 ºC at

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4 ºC/min; injector and detector temperatures, 280 ºC; injected volume 0.1 µl; split ratio, 1:50. The MS operating parameters were as follows: ionization potential, 70 eV; ionization current, 1 A; ion source temperature, 200 ºC and resolution of 1000.

Identification of components in the oil were based on retention indices relative to *n*-alkanes and computer matching with the WILEY 275.L library, as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literatures (25-28).

RESULTS

Aerial parts of *C. aucheri* (DC.) Wagenitz. yielded 0.16% (v /w *vs.* dried material) of oil with a strong aroma. Twenty-two components representing 80.03% of the total oil composition were characterized and results with their percentage composition are listed in table 1. The major constituents of the sesquiterpene-rich oil of *C. aucheri* (DC.) Wagenitz. were caryophyllene oxide (19.44%), β-caryophyllene (14%), geremacrene-D (13.38%). The oil contains: sesquiterpene hydrocarbons (50.1%) and oxygen-containing sesquiterpenes (27.24%).

Nearly 20 percent of the oil composition is unknown; which might be due to similarities of the pattern of their mass spectra of terpenoids or insufficient information about their RI in literatures. The mass spectra of main unidentified compounds (representing 12.94% of the total oil components) showed molecular ion peak at 220 m/z (fig. 1), which might be due to oxygen-containing sesquiterpenes (25).

Table 1. Components of the oil from the aerial parts of *Centaurea aucheri* (DC.) Wagenitz.

No.	Compound	RI[a]	Percentage
1	1-octen-3-ol	979	0.03
2	δ-elemene	1338	1.54
3	α- ylangene	1372	0.54
4	α- copaene	1375	1.29
5	β- elemene	1391	1.13
6	β-caryophyllene	1427	14.00
7	γ-elemene	1440	5.16
8	Aromadendrene	1444	0.44
9	α-humulene	1456	1.90
10	β-farnesene	1464	1.53
11	Germacrene –D	1487	13.38
12	β-selinene	1492	1.35
13	Bicyclo germacrene	1499	3.12
14	β- bisabolene	1511	0.28
15	γ-cadinene	1515	0.55
16	δ-cadinene	1526	0.84
17	Unidentified	1529	0.38
18	Unidentified	1535	1.65
19	α-cadinene	1539	0.45
20	α-calacorene	1545	0.45
21	Germacrene –B	1558	2.15
22	Unidentified	1566	1.23
23	**Caryophyllene oxide**	**1585**	**19.44**
24	Unidentified	1615	1.41
25	4-Hexadecen-6-yne*	1629	2.66
26	Iso spathulenol*	1660	7.80
27	Unidentified **	1673	5.47
28	Unidentified **	1702	2.45
29	Unidentified **	1713	4.99
30	Unidentified	1742	0.90
31	Unidentified	1791	0.68
32	Unidentified	1897	0.81

[a] Retention indices (RI) on HP_5- MS capillary column.

* Tentatively identified.

** Mass spectra are showed in Figure 1.

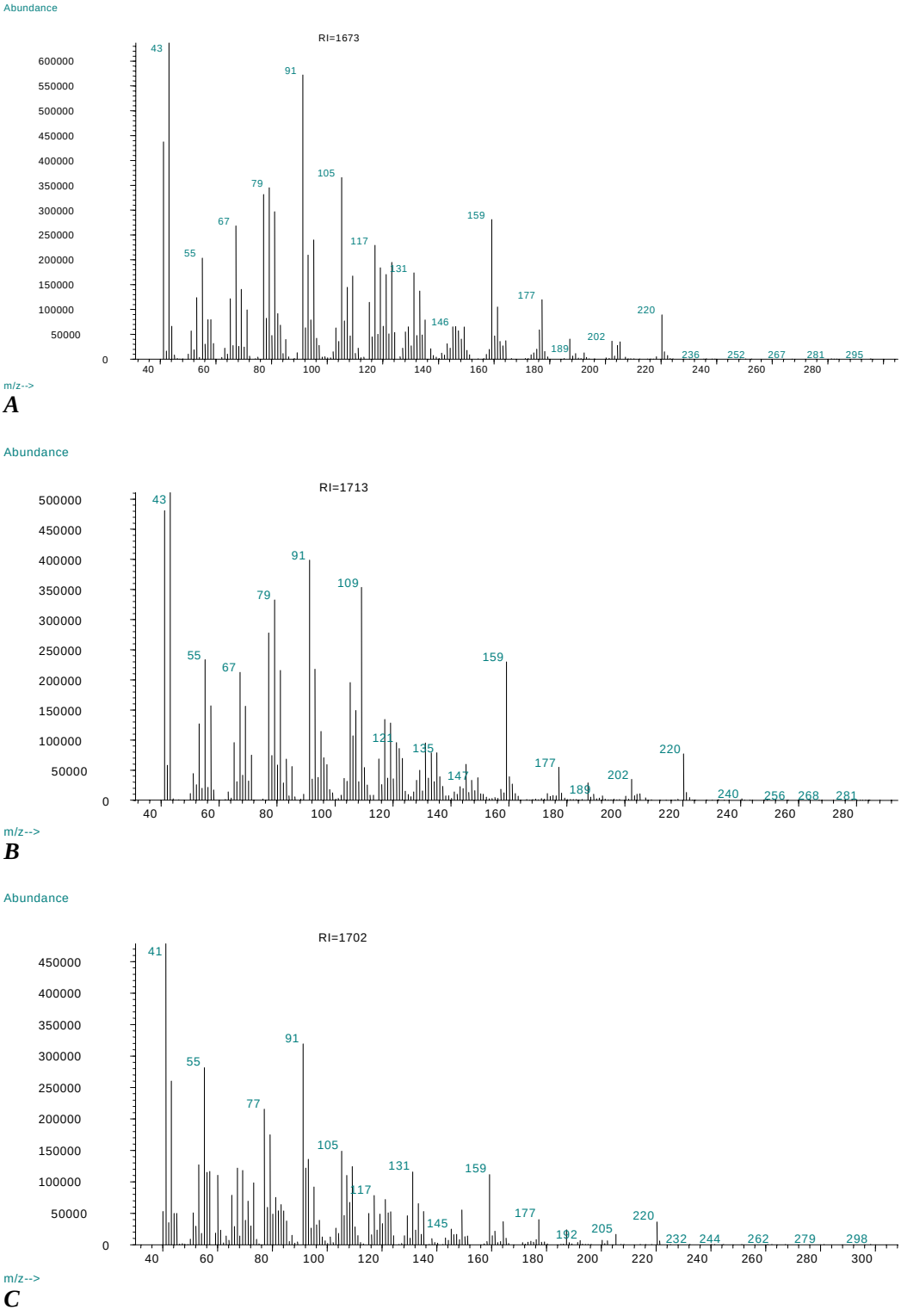

Figure 1. Mass spectra of main unidentified compounds of the oil of *C. aucheri* (DC.) Wagenitz. A: unidentified compound with RI=1673, B: unidentified compound with RI= 1713, C: unidentified compound with RI= 1702

DISCUSSION

A search through the literature (1, 6-16) showed that the amount of essential oil of *C. aucheri* (DC.) Wagenitz. (0.16%) is higher than C. *raphanina* subsp. *mixta* and *C. spruneri* (both 0.01%) (1), *C. cineraria* L. subsp. *umbrosa* (0.02%) and *C. napifolia* (0.08%) (6), *C. mucronifera* (0.09%) and *C. chrysantha* (0.09%)(7), and *C. pelia*, *C. thessala* subsp. *drakiensis* and *C. zuccariniana* (all 0.05%) (10). While *C. aucheri* (DC.) Wagenitz has a pale greenish volatile oil, another species have been reported (1,6,7,10) which have yellowish volatile oils.

Examination of the main volatiles which have been identified in *Centaurea* species (1, 6-16), show that *C. moschata* has a quite unique composition because of the presence of large amount of monoterpene (16), whereas in *C. aucheri* (DC.) Wagenitz., *C. pseudoscabiosa* subsp. *pseudoscabiosa*, *C. hadimensis*, *C. kotschyi* var. *kotschyi*, *C. kotschyi* var. *decumbens* and *C. solstitialis* have mainly sesquiterpenes (8, 11, 12, 13).

In *C. pelia*, *C. thessala* subsp. *drakiensis* and *C. zuccariniana*, *C. raphanina* subsp. *mixta* such as *C. aucheri* (DC.) Wagenitz., monoterpene hydrocarbons and alcohols are completely absent; and main volatiles are caryophyllene oxide (1, 10). Monoterpenes, likewise are almost absent in *C. chrysantha* (7) and *C. zuccariniana* (10).

β-Caryophyllene is one of the main volatile constituents of *C. raphanina* subsp. *mixta* and *C. spruneri* (1), *C. cineraria* subsp. *umbrosa* and *C. napifolia* (6), *C. mucronifera* and *C. chrysantha* (7), *C. pseudoscabiosa* subsp. *pseudoscabiosa* and *C. hadimensis*(8), *C. kotschyi* var. *kotschyi* and *C. kotschyi* var. *decumbens* (9) and *C. solstitialis* (11, 12, 13) such as *C. aucheri* (DC.) Wagenitz.

Germacrene-D is the major volatiles of *C. cineraria* subsp. *umbrosa* (6), *C. mucronifera* and *C. chrysantha* (7), *C. pseudoscabiosa* subsp. *pseudoscabiosa* and *C. hadimensis* (8), *C. kotschyi* var. *kotschyi* and *C. kotschyi* var. *decumbens* (9).

Diterpenes are not present in essential oil of *C. aucheri* (DC.) Wagenitz., but are found in the essential oils of *C. raphanina* subsp. *mixta* (1), *C. pelia*, *C. thessala* subsp. *drakiensis* , *C. zuccariniana* (10), and *C. cineraria* subsp. *umbrosa* , *C. napifolia* (6).

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