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Chemical composition of *Convolvulus cantabrica* essential oil from North Khorasan province of Iran

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Abstract

Background: Plants belonging to the family Convolvulaceae possess cytotoxic activity against a number of tumor cells. In order to have a better understanding of the pharmacologically active components of *Convolvulus cantabrica*, in this study, the chemical composition of the essential oil of *C. cantabrica* L. growing in North Khorasan province of Iran was investigated.
Materials and Methods: The aerial parts of the plant were collected at the early flowering stage in 2015 and the essential oil was obtained by hydrodistillation method and analyzed by GC/MS.
Results: The yield of the essential oil was quite low and 54 identified compounds comprised 68.33% of the total oil. The major components were palmitic acid (16.6%), cis-linoleic acid (7.17%), l-(+)-ascorbic acid 2, 6-dihexadecanoate (5.31%), diisobutyl phthalate (4.68%), methyl linoleate (2.64%) and germacrene-D (2.07%). The results showed that *C. cantabrica* contains fatty acids, and aliphatic and terpenoid compounds.
Conclusion: This quantitative analysis of *C. cantabrica* essential oil showed that fatty acids are the major constituents.

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Introduction

Convolvulus (family Convolvulaceae) is a genus that comprises 200 to 250 species, from which 60 species are native to Iran (Feinbrun- Dothan, 1978; Ghahraman, 1994). This genus is used as food by the larvae of *Lepidoptera* species (Jump et al, 2010). The plants belonging to the family Convolvulaceae have anti- cancer properties as they possess cytotoxic activity against a number of tumor cells (Atta and Mouneir, 2004). It has been reported that *Convolvulus* plants exhibit antimicrobial (Zain et al, 2012), anti-cancer (Todd et al, 1995), anti-stress (Sethiya and Mishra, 2010), anti-diarrhoeal (Atta and Mouneir, 2005), anticonvulsant (Verma et al, 2012), anti-angiogenesis (Calvino, 2002), antidiabetic (Marles and Farnsworth 1995), antifeedant (Bhakuni et al, 1996) and neuroprotective effects (Bihaqi et al, 2011). From the plants of *Convolvulus* genus, many compounds such as alkaloids (Mothes and Romeike, 1958), flavonoids (Rizk et al, 1982), coumarins, tannins, saponins, resin glycosides, sterols and stilbene derivatives (Wagner et al, 1983; Todd et al, 1995; Noda et al, 1990; El- Fiky et al, 1996; Dawidar et al, 2000; Menemen et al, 2002), triterpenoids , lactones, amino acids and glycosides (Anthonsen et al, 1976) have been isolated. Also, some phenolic compounds such as dorycnic acid and caffeic acid derivatives were isolated from *C. dorycnium* and *C. scammonia* (Nacef et al, 2010, Noda et al, 1990).

Given the importance of essential oils, the purpose of this study was to investigate the chemical composition of the essential oil obtained from the aerial parts of *C. cantabrica*. To the best of our knowledge, no report on the essential oil of *C. cantabrica* has been published to date.

Materials and Methods

Plant materials

The aerial parts of the plant were collected from the Baba-Aman Mountains, North Khorasan province, Iran, in May 2015. A voucher specimen of the plant (voucher No. NMP28/1-6) was deposited at Natural Products and Medicinal Plants Research Center, North Khorasan University of Medical Sciences, Bojnurd, Iran.

Isolation procedure

The essential oil was obtained using hydrodistillation method. Here, 40 g of the plant was added to 400 ml distillated water and the mixture was submitted to the Clevenger apparatus. A two-phase mixture consisting of water and oil was obtained and

separated by normal hexane. The oil was collected in the sample container after 4 hours and stored at 5°C in the dark in sealed glass vials until further analysis (Yamini et al, 2008).

GC-MS analysis

GC-MS analysis was done by a Shimadzu-QP2010SE 15A, equipped with an Rtx-5MS (30 m × 0.25 mm, 0.25 µm). Helium was used as the carrier gas with a flow rate of 0.9 ml/min. The retention indices for all components were calculated by using *n*-alkanes as standard. The compounds were identified by comparison of retention indices with those reported in Wiley and Nist libraries (Adams, 2001).

Results

The percentage of the identified components (%) and retention indices (RI) are summarized in Table 1. Fifty-four compounds were isolated and identified, accounting for 68.33 % of total essential oil. The oil was found to contain aliphatic alcohols, monoterpene hydrocarbons, aliphatic and aromatic hydrocarbons, oxygenated sesquiterpenes, alkene, sesquiterpene hydrocarbons, ketones, aldehydes, oxygenated monoterpenes, aliphatic esters and fatty acids. The main components were palmitic acid (16.6%), cis-linoleic acid (7.17%), l-(+)-ascorbic acid 2, 6-dihexadecanoate (5.31%), diisobutyl phthalate (4.68%), methyl linoleate (2.64%) and germacrene-D (2.07%).

Table 1. Chemicals isolated from the essential oil of *C. cantabrica*.

No	compound	*RI	%
1	α-pinene	957	0.1
2	Sabinene	993	0.6
3	Decane	1020	t
4	Linalool	1119	0.3
5	Nonanol	1183	0.1
6	Terpinene-4-ol	1191	0.1
7	α-terpineol	1205	0.2
8	Unknown	1221	0.1
9	Unknown	1246	t
10	Geraniol	1269	t
11	Decanol-۵	1286	0.1
12	Tridecane	1304	0.1

13	p-vinyl-guaiacol	1326	0.1
14	δ-elemene	1344	0.1
15	α-cubebene	1356	0.7
16	Eugenol	1369	1.7
17	Cyclosativene	1372	0.6
18	α-copaene	1383	5.2
19	β-bourbonene	1390	2.3
20	β-cubebene	1394	2.0
21	Tetrad cane	1402	0.4
22	α-funebrene	1409	1.2
23	α-gurjunene	1414	1.5
24	α-cedrene	1416	0.2
25	α-*cis* bergamotene	1423	6.0
26	Caryophyllene	1426	3.5
27	β-copaene	1433	0.6
28	α-*trans*-bergamotene	1439	2.2
29	Aromadendrene	1443	0.1
30	β-farnesene	1447	3.2
31	*Cis*-muurola-3,5-diene	1454	0.3
32	β-farnesene	1464	13.4
33	*Trans* cadina-1(6),4-diene	1479	0.7
34	Germacrene D	1487	11.6
35	*Trans*-muurola-4(14),5-diene	1496	0.6
36	Bicyclogermacrene	1503	6.6
37	β-bisabolene	1508	1.0
38	α-cuprenene	1515	4.4
39	γ-bisabolene	1518	2.8
40	α-cedrene	1526	3.7
41	α-*cis* bergamotene	1531	0.5
42	Caryophyllene	1533	0.4
43	β-copaene	1537	0.4
44	α-*trans*-bergamotene	1553	1.5
45	Aromadendrene	1561	0.7
46	β-farnesene	1567	0.5
47	Caryophyllene oxide	1578	1.7
48	Viridiflorol	1582	0.8
49	Fokienol	1590	1.2

50	Rosifoliol	1593	1.0
51	Epi-cedrol	1599	0.3
52	Junenol	1611	0.3
53	α-acorenol	1613	0.2
54	β-acorenol	1626	2.1
55	Epi-α-muurolol	1629	0.3
56	β-eudesmol	1636	1.9
57	α-cadinol	1646	0.5
58	Epi-β-bisabolol	1650	1.6
59	Epi-α-bisabolol	1663	2.7
60	α-bisabolol	1674	0.6
61	Germacra-4(15),5,10(14)-trien-1-α-ol	1676	0.3
62	Heptadecane	1679	0.3
63	Octadecane	1683	0.9
64	Nonadecane	1776	0.5
65	Caryophyllene oxide	1870	0.6
39	Viridiflorol	957	0.1
40	Fokienol	993	0.6
41	Rosifoliol	1020	t
42	Epi-cedrol	1119	0.3
43	Junenol	1183	0.1
44	α-acorenol	1191	0.1
45	β-acorenol	1205	0.2
46	Epi-α-muurolol	1221	0.1
47	β-eudesmol	1246	t
48	α-cadinol	1269	t
49	Epi-β-bisabolol	1286	0.1
50	Epi-α-bisabolol	1304	0.1
51	α-bisabolol	1326	0.1
52	Germacra-4(15),5,10(14)-trien-1-α-ol	1344	0.1
53	Heptadecane	1356	0.7
54	Octadecane	1369	1.7
55	Nonadecane	1372	0.6
56	Caryophyllene oxide	1383	5.2
57	Viridiflorol	1390	2.3
58	Fokienol	1394	2.0

59	Rosifoliol	1402	0.4
60	Epi-cedrol	1409	1.2
61	Junenol	1414	1.5
62	α-acorenol	1416	0.2
63	β-acorenol	1423	6.0
64	Epi-α-muurolol	1426	3.5
65	β-eudesmol	1433	0.6

* % = concentration in percentage, ** RI = retention index calculated

Discussion

Chemical composition of the essential oils of several species of *Convolvulus* had been shown by researchers. For example from the essential oil of *C. persicus*, 20 components representing 89.0 % of the total oil, were characterized with β-caryophyllene (47.0%), dodecanal (8.8%), caryophyllene oxide (5.7%), tetradecanal (4.4 %) and dihydroedulan I (4.4 %) being the major components (Dehghan et al, 2015). In another study, a total of 24 compounds, accounting for 95.5% of the total oil, have been identified in the essential oil of *C. althaeoides* and the main compounds were germacrene-D (12.5%), T-cadinol (11.8%) and verbenone (6.9%) (Hassine et al, 2014). In the present work, quantitative analysis of the essential oil of the aerial parts of *C. cantabrica*, collected from the Northeast of Iran, showed that fatty acids are the major constituents (about 10 compounds out of the 54 identified compounds) of its essential oil.

Conclusion

Fatty acids are the major constituents of the essential oil of *C. cantabrica*.

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Conflict of interest

The authors have no competing interests to declare.

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