INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 4, No. 1, p. 372-377, 2014

RESEARCH PAPER OPEN ACCESS

Essential oil composition of *Allium ampeloprasum* L. var. *atroviolaceum* and *Allium iranicum*

Fatemeh Bareemizadeh*, Naser Karimi, Hamid Reza Ghasempour, Seyed Mohammad Maassoumi, MojtabaTaran

Department of Biology, Razi University, Kermanshah, Iran

Key words: *Allium,* Beta-pinene, D-limonene, essential oil compounds, mass spectroscopy.

http://dx.doi.org/10.12692/ijb/4.1.372-377 Article published on January 11, 2014

Abstract

The subgenus *Allium* section includes economically and medicinally important species, such as garlic and leek as well as other polyploidy minor crops. In this study, essential oil constituents of *Allium ampeloprasum* var *atroviolaceum* and *Allium iranicum* growing wild in Kermanshah, Iran were investigated through GC and GC/MS technique.In the essential oil of *Alliumampeloprasum,* 22 compounds have been identified.D-limonene (26.977 %), Beta-pinene (25.309 %), Trans-caryophylene (7.390 %), Dimethyl trisulfid (2.432 %), Caryophylene oxide (1.205 %), Elemene (0.835 %), Dimethyl tetrasulphide(0.729 %), Alpha-pinene (0.524 %), Gamma terpinene (0.449 %), Beta-myrcene (0.35 %), Farnesene(0.304 %) and Alpha-terpineol (0.241%) were in the main components of essential oil.Nine compounds, representing 7 (86.65%) of the total oil were identified. The main componentswere: Beta-pinene (49.96 %), dimethyl-Trisulfide (15.82 %), L-Limonene (12.10%), Trans-Caryophylene (5.49%), SantolineTriene (1.27%), dimethyl-tetrasulfide (1.32%), Alpha-pinene (0.69%).

* **Corresponding Author:** Fatemeh Bareemizadeh ✉ fbareemizadeh@yahoo.com

Introduction

In many developing countries, some plant materials play an important role in PHC (Primary Health Care) (Sokmen *et al.*, 1999, Brophy *et al.*, 2004). Some medicinal substances produced by aromatic plant such as essential oils have antimicrobial activity (Cowan, 1999, Sebastian *et al.*, 2007). Even though that vast amount of chemical drugs with antimicrobial activity is developing, still some herbal drugs are used for the prevention and treatment of infectious diseases in some countries (Federspil *et al.*,1997, Inouye *et al.*, 2001)**.** In the essential oil of aromatic plants, there are many compounds such as monoterpenes, sesquiterpenes, alcohols, aldehides, phenols, esters, and other, sulphorous and nitrogenous substanceswhich all of these mentioned constituents have medicinal activities (Ghasempour *et al.*, 2012, Anil John *et al.*, 2008).

Allium genus that is relevant to the Alliaceae familyconsists of hundreds of medicinal species in the world andit is one of the most imperative sources of life supporting drugs (Hirschegger *et al.*, 2010). *Allium ampeloprasum* and *Allium iranicum* species are utilized as a medicinal herb in local and traditional medicine (in Iran). The bulbous of these species have been used for treating inflammatory symptoms (Rodrigues *et al.*, 2011). The fresh juice is taken orally as a stomachic and antispasmodic and is also reputed to posse's digestive properties (Nathalie *et al.*, 2012). Because of important species of *Allium*, the aim of this study was to analyze and clarify the medicinal constituents of essential oils of *Allium ampelopraasum* and *Allium iranicum*.

Materials and methods

Plant material

The aerial parts of *Allium ampeloprasum* L.varatroviolaceum Regel and *Allium iranicum* wendelbo (wendelbo) were collected from wild plants grown at mountain slopes at different habitatsof Kermanshah city suburbs (West of Iran). The voucher specimen is deposited in the Herbarium of Agricultural Faculty of Razi University, Kermanshah, Iran. The aerial parts of two species were cut in to pieces and air-dried for 10 days at room temperature. Then, 70gr of dried aerial parts of each two specieswere powdered, mixed with 500 ml distilled water distinctively and essential oils were hydro distilled in a clevenger apparatus according to the British method for 3 hrs.

Gas chromatography

GC analysis of the oil was conducted by using a Thermoquest-Finnigan Trace GC instrument equipped with a HP-5 fused silica column (60m x 0.25mm i.d., film thickness 0.25 µm). Nitrogen was used as the carrier gas at the constant flow of 1.1 ml min^{-1}. The oven temperature was held at 60°C for 1 min, then programmed to 250°C at a rate of 4°C min^{-1} and then held for 10 min. The injector and detector (FID) temperatures were kept at 250 and 280°C, respectively.

Gas chromatography-Mass spectrometry

GC-MS analysis was carried out on a Thermoquest-Finnigan Trace GC-MS instrument equipped with a HP-5 fused silica column (60 m x 0.25 mm i.d., film thickness 0.25µm).Helium was used as a carrier gas at a flow rate of 1 ml/min.The oven temperature was raised from 60 to 250°C at a rate of 5°C $min^{-1}$and then held at 250°C for 10 min., transfer line temperature was 250°C. The quadrupole mass spectrometer was scanned over the 45-465amu with an ionizing voltage of 70 ev and an ionization current of 150 µa. Peak identification was carried out by calculation of Kovats retention indexes (RI) from retention times of n-alkanes (C6–C24) and sample components (Adams, 2005).

The list of identified components is presented in table 1. The constituents of components were identified by comparing their MS spectra with those in computer library orwith authentic compounds. The identifications were confirmed by comparison of theirretention indices either with those of authentic compounds or with data in the literature (13–15).

Results

The list of identified components of both *Allium*

species is presented in tables 1,2 and figures 1,2.

Essential oil components of Allium ampeloprasum l. var atroviolaceum

In the aerial parts of *A. ampeloprasum* l. var atroviolaceum, the major identified components and the relative amounts based on peak area (fig. 1) were: D-limonene (26.977%), Beta-pinene (25.309%), 9-octadecanoic acid (17.343%), Hexadecanoic acid (14.917 %), Trans-caryophylene (7.390%), Dimethyl trisulfid (2.432%), Caryophylene oxide (1.205%), Elemene (0.835%), Dimethyl tetrasulphide (0.729%), 1-heptadecane (0.57 %), Alpha-pinene (0.524%), Gamma terpinene (0.449%), 2,5-diethyl phenol (0.416 %), Beta-myrcene (0.35%), Farnesene (0.304%), Alpha-terpineol (0.241%).(table 1).

Table 1. Chemical composition of identified compounds in the essential oil of *Allium ampeloprasum* l.var, atroviolaceum. RI: linear retention indices on column.Peak identification was carried out by calculation of Kovats retention indexes (RI) from retention times of n-alkanes (C6–C24) and sample components (Adams, 2005).

NO	COMPONENT	٪	RT	RI
1	Alpha-Pinene	٪0.524	6.452	932
2	Dimethyl trisulfide	٪2.432	7.469	962
3	Beta-Pinene	٪25.309	7.595	976
4	Beta-myrcene	٪0.350	7.886	989
5	Camphene	٪0.037	8.612	1012
6	d-limonen	٪26.977	9.001	1030
7	Cymene	٪0.151	9.463	1037
8	Gamma terpinene	٪0.449	9.778	1054
9	Ethanone 1-(4-methyl phenyl)	٪0.219	13.510	1132
10	Alpha- terpineol	٪0.241	13.727	1175
11	Dimethyl tetrasulphide	٪0.729	14.361	1216
12	4-methyl-betamethylenebenzeneethanthiol	٪0.099	15.036	1264
13	2,5- diethyl phenol	٪0.416	17.105	1320
14	Elemene	٪0.835	19.012	1389
15	Trans- caryophylene	٪7.390	19.785	1418
16	Caryophylene oxide	٪1.205	22.814	1582
17	Valerenol	٪0.304	23.998	1654
18	7-hydroxycadalene	٪0.103	24.323	1726
19	Tetradecane	٪0.101	25.341	1780
20	Hexadecanoic acid	٪14.917	26.438	1966
21	9- octadecanoic acid	٪17.343	27.821	1980
22	1-heptadecane	٪0.570	29.587	1992

Table 2. Chemical composition of identified compounds in the oil of *Allium iranicum* wendelbo (wendelbo). RI: linear retention indices on column. Peak identification was carried out by calculation of Kovats retention indexes (RI) from retention times of n-alkanes (C6–C24) and sample components (Adams, 2005).

NO	COMPONENT	٪	RT	RI
1	Alpha- pinene	0.69	6.22	932
2	Dimethyl- Trisulfide	15.82	7.77	962
3	Beta- pinene	49.96	8.12	976
4	l- limonene	12.10	11.54	1030
5	Dimethyl- tetrasulfide	1.32	15.01	1216
6	Trans- caryophylene	5.49	19.72	1418
7	Santoline Triene	1.27	25.21	1720
8	Hexadecadienoic acid	5.99	27.34	1966
9	9,12- octadecadienoic acid	5.83	29.89	1982

Essential oil components of Allium iranicum

In the essential oil of *Allium iranicum* 9 compounds has been identified (table 2, fig. 2). Beta-pinene (49.96%), dimethyl-Trisulfide (15.82%), L-Limonene (12.10%), Octadecadienoic acid (5.83%), Trans-Caryophylene (5.49%) were the main components. Similarly, both species are highlyidenticalin essential oil constituents due to indistinguishable chemical compounds.

Discussions

At present, there is an increasing interest both in industry and scientific research in spices and aromatic herbs because of their strong antioxidant and antimicrobial properties (Aldermaston, 1974). These properties are due to many substances, including some vitamins, flavonoids, terpenoids, carotenoids, phytoestrogens, minerals, etc. and render spices and some herbs or their antioxidant components as preservative agents in food (Calucci. *et al.*, 2003). In this investigation, the volatile constituents in the essential oil of *A. ampeloprasum* varatroviolaceum and *A. iranicum* which grow wild in Kermanshah, Iran were investigated by GC and GC/MS technique. As it is seen in table 1, two components in *A. ampeloprasum*, D-limonene (26.977%) and Beta-pinene (25.309%), have the highest percentage among the 26 components that were identified. Some other components like 9-octadecanoic acid (17.343%), Hexadecanoic acid (14.917%), Trans-caryophylene (7.390%) are located in the second level of the concentration in the essential oil. Although, in accordance with the data in table 1, some components i.e., Dimethyl trisulfid, Caryophylene oxide, Elemene, Dimethyl tetrasulphide, 1-heptadecane, Alpha-pinene, Gamma terpinene, Beta-myrcene, Farnesene, Alpha-terpineol have the medium to low relative percentages.The essential oils from aerial parts of *A.iranicum* showed three major constituents (Table 2): Beta-pinene (49.96%), dimethyl-Trisulfide (15.82%) and L-Limonene (12.10%).

Beta-pinene and limonen were found to be the major constituents in both species.

Biological and aroma effects of the major and minor compounds of the essential oil of both *Allium* species are discussable in terms of their possible use in medicine, cosmetics, and foods (Shan-Shan *et al.*, 2005). Beta pinene has the highest percentage in both Allium species. This kind of natural aroma chemical is widely used as raw material in the manufacture of myrcenes, menthols, citronellols, geraniols, nerols, resins and in many other organic systhetic industries. It is further processed to produce a range of aroma chemicals, including geraniol, citral, citronellol and ionones. High optical purity beta pinene is also applied in eco-friendly pesticides and pharmaceutical intermediates industries. Limonene is common applied in cosmetic products. D-limonene is used in food manufacturing as a flavoring to mask the bitter taste of alkaloids, and as a fragrant in perfumery.The (*R*)-(+) enantiomer of this compound is used as botanical insecticide, odorant, and in flavoring (Sun, 2007).

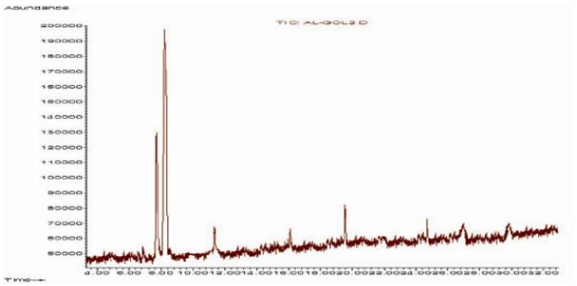

Fig. 1. Peak *Allium ampeloprasum* l.var, atroviolaceum REGEL**.**

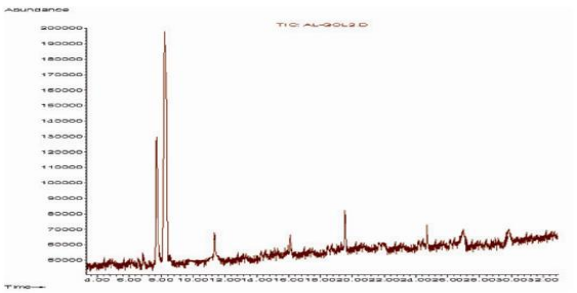

Fig. 2. Peak *Allium iranicum* wendelbo (wendelbo).

Allium ampeloprasum var atroviolaceum and *Allium iranicum* belong to Allium genus which was collected from Kermanshah area in Iran. It is utilized as a medicinal herb for the various purposes in local and traditional medicine by folks in Iran. Twenty-nine and nine components in the essential oil of *Allium*

iranicum and *Allium ampeloprasum* were identified respectively through GC and GC/MS technique. D-limonene (26.977%) and Beta-pinene (25.309%) in *Allium ampeloprasum*, and Beta-pinene (49.96%), dimethyl-Trisulfide (15.82%) in *Allium iranicum* have the highest percentages among compounds of the essential oil.

References

Adams RP. 1995. Identification of Essential Oil Components by Gas Chromatography/Mass Spectroscopy, 78–330p, Allured Publishing Corporation, Illinois.

Adams RP. 2005.Identification of essential oil components by gas chromatography/ mass spectroscopy. Allured Publishing Corporation, Carol Stream, IL, USA.

Aldermaston. 1974. Eight Pick Index of Mass Spectra, 2nd Edn, Mass Spectroscopy Data Center, Reading, UK.

Anil John J, Oswin Jose J, George V, Pradeep NS, Sethuraman MG. 2008. Volatile constituents and antibacterial activity of leaf oil of Thottea ponmudiana. Journal of Essential Oil Resolution **20,** 460-463.

Brophy JJ, Goldsack RJ, Hutton I. 2004. Leaf oils of the indigeneous Melicope (Rutaceae) of Lord Howe Island. Journal of Essential Oil Resolution **16,** 449-453.

Calucci L, Pinzono C, Zandomeneghi M, Capocchi A. 2003 Effects of gamma-irradiation on the free radical and antioxidant contents in nine aromatic herbs and spices. Journal of Agricultural Food Chemistry **51,** 927-934.

Cowan MM. 1999. Plant products as antimicrobial agents. Clinical Microbiology Review **12,** 564-582.

Federspil P, Wulkow R, Zimmermann T. 1997. Effects of standardized Myrtol in therapy of acute sinusistis. Results of a double-blind randomized multicenter study compared with placebo. Laryngorhinootologie **76, 23-7.**

Ghasempour HR, Shirinpour E, Heidari H. 2007. Analysis by gas chromatography-mass spectrometry of essential oil from seeds and aerial parts of Ferulago angulata (schlecht.) Boiss gathered in Nevakoh and Shahoo, Zagrossmountain, West of Iran. Pakistan Journal of Biological Sciences **10(5),** 814-817.

Ghasempour HR, Shokouh D, Mitra C. 2012. The composition of the volatile oil, tissue culture and microregeneration optimization of wild Yarrow (Achillea Biebersteinii). Iranian Journal of Plant Physiology **3(1),** 539-546 p.

Hirschegger P, Trontelj P, Bohanec B. 2010. Origins of Allium ampeloprasum horticultural groups and a molecular phylogeny of the section Allium (Allium: Alliaceae). Molecular Phylogenetics and Evolution **54,** 488–497. http://dx.doi.org/10.1016/j.ympev.2009.08.030**.**

Inouye SH, Yamaguchi H, Takizawa T. 2001. Screening of the antibacterial effects of a variety of essential oils on respiratory tract pathogens, using a modified dilution assay method. Journal of Infectious Chemotherapy **7,** 251-254.

Jennings W, Shibamoto J. 1980. Quantitative Analysis of Flavour and Fragrance Volatiles by Capillary Gas Chromatography, Academic Press, New York.

Nathalie B, Domien De P, Charlotte B, Hervé De C, Derek S, Erik Van B, Marc De L, Bart Van D. 2012.Antioxidant capacity, total phenolic and ascorbate content as a functionof the genetic diversity of leek (Allium ampeloprasum var. porrum). journal homepage: www.elsevier.com/locate/foodchem. Food Chemistry **134,** 669-677.

Rodrigues AC, Pereira da SB, Parente JP. 2011.

A new steroidal saponin from Allium ampeloprasum var. porrum with anti inflammatory and gastro protective effects. Phytochemistry Letters **4,** 306–310.

Sebastian S, Ushanandini S, Padmarani S. 2007. Medicinal plants-The aroma of life**.** Agrobios Newslett **6,** 36-38.

Shan-Shan Y, Wen-Fei G, YI L, Yuan-Xun J. 2005 Flavor Characteristics of Lapsang Souchong and Smoked Lapsang Souchong, a Special Chinese Black Tea with Pine Smoking Process", Journal of Agricultural and Food Chemistry **53(22).**

Sokmen A, Jones BM, Erturk M. 1999. The in vitro antibacterial activity of Turkish medicinal plants. Journal of Ethnopharmacol **67,** 79-86.

Sun J. 2007. D-Limonene: safety and clinical applications. Alternative medicine review. a journal of clinical therapeutic **12(3),** 259–64. PMID 18072821.