Advanced Herbal Medicine, 2016; 2(1): 1-6.

herbmed.skums.ac.ir

Qualitative and quantitative changes of essential composition in the flowers of some populations of *Elaeagnus angustifolia*

Faranak Elmi[1], Gholamreza Dehghan[1*], Behnam Beigzadeh[2]
[1]*Biology Dept., University of Tabriz, Tabriz, I.R. Iran;* [2]*Phytochemistry Dept., Azarbaijan Shahid Madani University, Tabriz, I.R. Iran.*
Received: 25/Feb/2016 Accepted: 26/Apr/2016

ABSTRACT

Background and aims: *Elaeagnus angustifolia* L. is a member of the Elaeagaceae family; different parts of it, especially fruits have been used for the treatment of several diseases in traditional medicine. The aim of this study was to isolate and determine essential oil composition of flowers of *E. angustifolia* collected from different ecological areas of East-Azarnayjan in Iran.
Methods: In this experimental study, the essential oils of the flower were isolated by hydrodistillation method and analyzed by GC and GC/MS.
Results: The number of compounds in the essential oil isolated from the population of Ahar, Marand and Hashtroud were 22, 17 and 14, respectively. The major component of all of the populations was ethylcinnamate; Ahar (47.59%), Marand (69.99%) and Hashtroud (85.49%). It was observed that the oil number of *E. angustifolia* decreases from 22 to 14 when the altitude increases from 1344-1750 m.
Conclusion: Chemical composition of the essential oils of *E. angustifolia* L. such as esters and aromatic acids contents were increased while the ketone content was decreased with increasing altitude.

Keywords: *Elaeagnus angustifolia*, Essential oils, GC/MS, Esters, Ketones.

Original article

INTRODUCTION

Elaeagnus angustifolia L. subspecies *Elaeagnaceae* is cultivated from the northern areas of Asia to the Himalayas and Europe because of its capacity to grow in different environmental conditions.[1] The *Elaeagnaceae* family comprises three genera and about 51 species in North America and Eurasia as far southwards as Malaysia and Australia.[2] *E. angustifolia* is a deciduous small tree or shrub that can reach a height of 5-10 m. The plant has shiny brownish red spines. Stems, leaves, flowers, and fruits are covered with silver-white scales.[3] Appearing from May to June, the fragrant flowers are erect or nearly erect, and have bell-shaped calyx tubes and a conspicuous, glabrous, conical floral disc, which surround the base of the style.[4]

In folk medicine, *E. angustifolia* (Russian olive) fruit and flower are used as a

[*]**Corresponding author:** Gholamreza Dehghan. Biology Dept., University of Tabriz, Tabriz, I.R. Iran, Tel: 00989123583592, E-mail: dehgan2001d@yahoo.com

tonic and antipyretic agent. Also, it is used for treatment of urinary diseases, gastric disorders, diarrhea, nausea, vomiting, jaundice, asthma and flatulence.[5,6] In the Iranian traditional remedies, *E. angustifolia* fruit has been used as an analgesic agent for reducing of pain in rheumatoid arthritis.[7] This genus has a wide distributional range and the differences in oil composition may be affected by different environmental factors such as plant genetic type, seasonality, and developmental stage.[8] Essential oils extracted from the flowers are used in the manufacture of perfumes and flavorings. According to studies, within the last years, an average of 45 compounds have been identified in samples of different populations.[9,10] Esters and aromatic acids (Ethyl cinnamate, benzoic acid, benzeneacetic acid, salicylic acid, cinnamic acid, hydroxyl cinnamic acid and 4-hydroxy-3-methoxybenzoic acid) are the principle components of the flower essential oil of *E. angustifolia*.[11] According to Yan Hongjian and Zhang Huaiqin studies, in some *E. angustifolia* populations, essential oil components (methyl cinnamate and propanoic acid) are in the next ranks.[12] Also it has been reported that, the aromatic acids belonging to the n-hexanoic acid and 4-hydroxlbenzoic acid are the most frequent components of the flowers of *E. angustifolia* populations. Ketones such as geranyl acetate and hexahydro-farnesyl acetone, are the most frequent constituents.[13,14] Some researchers have reported the major constituent of several *E. angustifolia* populations as ethyl cinnamate, hexanoic acid, benzoic acid and octanoic acid in China.[15]

METHODS

In this experimental study, plant materials of *E. angustifolia* populations were collected from four different places in East-Azarbayjan province of Iran during the flowering period, in May at 2012. The location, the plant populations and altitudes are listed in Table 1. The collection area has the characteristics of terrestrial climate. The climate is characterized by warm to hot, temperate summer and freezing snowy winters. Flowers of *E. angustifolia* populations were dried under shadow at room temperature. All samples were hydro-distilled for essential oil by grossly pulverized powdered flowers (50 g) using a Clevenger type apparatus for 3 h.

Table 1: Location of investigated *E. angustifolia* populations

Population	Collected area	Altitutes(m)
Ea $_{(T)}$	Ahar	1344
Ea $_{(M)}$	Marand	1550
Ea $_{(A)}$	Hashtroud	1750

The EOs were analyzed using an Agilent 6890 gas chromatograph- mass spectrometer fitted with HP-5MS capillary column (30 m×0.25 mm). Helium was used as carrier gas at a flow rate of 0.7 mL/min. The oven temperature was kept at 60 °C for 5 min and programmed to 280 °C at a rate of 3°C/min and then kept constant for 5 min. The injector temperature was 280 °C and split ratio was adjusted at 1:67. The MS were taken at following condition: ionization potential, 70 eV; ion source temperature, 280 $^{\circ}$C; quadruple 100 °C. Identification of compounds was based on direct comparison of the retention times and mass spectral data with those for standard compounds, and computer matching with the NIST NBS54K Library, as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literature.[16,17]

RESULTS

A total of 22 components of the essential oils of population Ahar (Ea_A) flowering aerial parts were identified (Table 2). Ethyl cinnamate (47.59%), hexahydro-fanresyl acetone (11.63%), dibutyl phthalate (7.00%), hexadecanoic acid (5.96%) and propanoic acid (5.36%) were the five main constituents of *E. angustifolia* essential oil followed by benzoic acid (1.84%) and octanoic acid (1.70%). A total of 17 components of the essential oil of the population Marand (Ea_M) (Table 2) flowering aerial parts were identified. The principal compounds in population Marand (Ea_M) oil were ethyl cinnamate (69.99%), hexanoic acid (7.22%), hexahydro-farnesyl acetone (3.74%) and dibutyl phthalate (2.33%). A total of 14 components of the essential oil of population Hashtroud (Ea_H) (Table 2) were identified, accounting for 95.25% of the total oil. Ethyl cinnamate (85.49%), hexahydro-farnesyl acetone (2.84%), benzoic acid (1.85%) were the three main constituents of population Hashtroud essential oil.

Table 2: Constituents identified from the essential oils of *E. angustifolia* populations.

Compound	RT	Ea(A) (%)	Ea(M) (%)	Ea(H) (%)
Nonanal	4.93	1.09	0.58	0.54
Nonanoic acid	6.09	0.59	-	-
Propanoic acid	6.88	5.36	-	-
Decanal	8.61	0.16	0.11	-
Decanoic acid	9.39	1.25	-	-
Butenoic acid	10.45	0.84	-	-
Ethyl cinnamate	10.65	47.59	69.99	85.49
Tridecane	11.20	0.92	-	-
Tridecanal	11.82	-	0.24	0.14
Megastigmatrienone	12.17	1.26	0.94	1.05
Geranyl actone	12.60	-	2.02	-
Nerolidol	12.96	1.39	-	-
Farnesol	13.44	0.93	0.51	-
Hexadecanal	13.63	0.48	0.40	0.22
Hexadecane	13.99	0.61	-	0.20
Dibutyl phthalate	14.29	7.00	2.33	0.84
Hexadecanoic acid	14.46	5.96	7.22	0.11
Heptadecane	14.59	-	-	0.20
Benzoic acid	15.11	1.84	1.52	1.85
Octadecanal	15.21	0.18	0.14	-
Octadecane	15.56	0.42	0.14	-
Hexafarnesyl acetone	15.69	11.63	3.74	2.84
Octadecanoic acid	15.99	1.70	-	-
Nonadecane	16.18	-	0.96	0.36
Phytol	16.61	2.64	1.74	0.70
Heneicosane	16.79	0.24	0.66	0.71
Total identified		94.08	93.24	95.25
Esters and Acids		72.13	81.06	88.29
Ketones		12.89	6.7	3.89
Others		9.06	5.48	3.07

DISCUSSION

The aim of the present study was to determine the chemical composition of the essential oils from flowers of some populations of *E. angustifolia* from different locations of East-Azarbayjan in Iran. Comparing the average yield of essential oils of *E. angustifolia* from three regions of Marand, Ahar and Hashtroud doesn't shows significant differences. Despite the notable qualitative and quantitative similarities between the oils of the subjected populations, it was shown some alterations in oil's constituents. For example, ethyl cinnamate content, as a major component of the oils, in the Hashtroud population (85.49%) was more than the other two populations (Marand 69.99% and Ahar 47.59%), as well as the hexahydro-farnesyl acetone, in the sample of Ahar region (11.63 percent) was more than two other areas. This variability is likely due to differences in chemotype, environmental and geographical conditions of the areas of study. Major components of the oils were esters, which oils obtained from Hashtroud population has the highest (88.29%) and population of Ahar region has the lowest amounts of them (72.13%).

Previous studies that have determined the chemical composition of *E. angustifolia* essential oils also identified high levels of decanoic acid, methyl cinnamate, benzenmethanol.[18] The main constituents of the oils of *E. angustifolia* from China, are different from those in our study. For example, the main components of essential oil of *E. angustifolia* were linoleic acid, palmitic acid and germacrene D.[19] Esters and acids represented 81.06% of compounds, while 6.7 constituents were ketons.[20] In another study, the main constituents of the oil of the plant collected from Chaina were ethyl cinnamate, followed by 9-octadecenoic acid ethyl ester and n-hexadecanoic acid. In addition, relatively high amounts of n-propyl acetate, 2-pentadecyn-1-ol and 9- octadecenal were also found in the essential oils of *E. angustifolia* .[21] Eighty five components in the volatile oil of flowers of *E. angustifolia* L from Chaina were reported previously in which trans-ethyl cinnamate (78.88%) and hexahydrofarnesyl acetone (6.31%) were the main ones.[22] In another study, the main constituents of the oil of the plant collected from Romania were ethyl cinnamate, 2-phenyl-ethyl benzoate and 2-phenylethyl isovalerate of which ethyl cinnamate and 2-phenyl-ethyl benzoate were two major compounds of the oil of this study.[23] This suggests that there is a great variation in chemical composition of the essential oils derived from different populations of *E. angustifolia*.

CONCLUSION

The essential oil constituents of the flower of *E. angustifolia* collected from different locations of East-Azarbayjan in Iran were studied. Our results demonstrate that ethyl cinnamate is the main content of the oils. Variations in the qualitative and quantitative composition were shown in the oils obtained from the flowers of populations of *E. angustifolia*, collected from three different locations. These differences can probably be attributed to the genetic differences or different geographic

or environmental conditions of the plant materials.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENT

The authors thank all individuals in Department of Biology, University of Tabriz for their help.

REFERENCES

1. Klich MG. Leaf variations in *Elaeagnus angustifolia* related to environmental heterogeneity. Environ Exp Bot. 2000; 44(3): 171-83.

2. Hosseinzadeh H, Ramezani M, Namjo N. Muscle relaxant activity of *Elaeagnus angustifolia* L. fruit seeds in mice. J Ethnopharmacol. 2003; 84(2-3): 275-8.

3. Iriondo JM, De La Iglesia M, Perez C. Micropropagation of *Elaeagnus angustifolia* from mature trees. Tree Physiol. 1995; 15(10): 691-3.

4. Nikolaeva A, Krivenchuk P, Prokopenko A. Phenolic compounds of *Elaeagnus angustifolia*. J Khimiya Prirodnykh Soedineni. 2005; 6(6): 256.

5. Karimi G, Hosseinzadeh H, Rassoulzadeh M, Razavi BM, Taghiabadi E. Antinociceptive effect of *Elaeagnus angustifolia* fruits on sciatic nerve ligated mice. J Basic Med Sci. 2010; 13(3): 97-101.

6. Gurbuz I, Ustun O, Yesilada E, Sezik E, Kutsal O. Anti-ulcerogenic activity of some plants used as folk remedy in Turkey. J Ethnopharmacol. 2003; 88(1): 93-7.

7. Zargari A. Medicinal plants. Tehran: Tehran University Press; 1990; 4: 27-38.

8. Pearce CM, Smith DG. Plains cottonwood's last stand: Can it survive invasion of Russian olive onto the Milk River, Montana floodplain? Environ Manage. 2001; 28(5): 623-37.

9. Ramezani M, Hosseinzadeh H, Daneshmand N. Antinociceptive effect of *Elaeagnus angustifolia* fruit seeds in mice. J Ethnopharmacol. 2003; 84(13): 275-80.

10. Pirbalouti AG, Malekpoor F, Enteshari S, Yousefi M, Momtaz H, Hamedi B. Antibacterial activity of some folklore medicinal plants used by Bakhtiari tribal in Southwest Iran. Intl J Biol. 2010; 2(2): 55.

11. Jinshun L. Analysis of volatile and semi-volatile components from flower of *Elaeagnus angustifolia*. Sci Silvae Sin. 2007; 43(3): 122.

12. Hongjian Y, Huaiqin Z. Analysis of chemical constituents of the *Elaeagnus angustifolia* L. flowers by GC/MS. J Chinese Mass Spectrometry. 1989; 10(2): 59.

13. Goncharova NP, Glushekova AI. Extract of *Elaeagnus angustifolia* flowers. Chem Nat Compd. 2009; 33(3): 276-7.

14. Wang Y, Zhaokun ZP. Gas chromatographic-mas spectrometric analysis of aroma compositions from flowers of *Elaeagnus angustifolia* L. extracted by supercritical Co_2 fluid. J Flavour Fragrance Cosmetics; 2007; 3(1): 72.

15. Bekker N, Glushenkova A. Components of certain species of the *Elaeagnaceae* family. Chem Nat Compd. 2001; 37(2): 97-116.

16. Adams RP. Identification of essential oil components by GC/. J Am Soc Mass Spectrom. 2006; 16(11): 22-9.

17. Masada Y. Analysis of essential oils by gas chromatography and mass spectrometry. Chem Nat Compd. 2003; 32(2): 33-6.
18. Li HJ, Yang J. GC/MS analysis of chemical composition of volatile oil from flowers of *Elaeagnus angustifolia*. J Food Sci. 2001; 58(11): 275-7.
19. Wang CQ. Chemical composition of the flower essential oils *Elaeagnus angustifolia*. Adv Mat Res. 2012; 34(6): 162-4.
20. Chen Y, Guo-qiang G. Gas chromatographic-mass spectrometric analysis of essential oil extracted by supercritical CO_2 from flowers of *Elaeagnus angustifolia* L. Food Sci. 2013; 34(5): 152-6.
21. Junhua H, Chaofeng W. Present situation and prospect about the study of *Elaeagnus angustifolia* L. J Chinese Wild Plant Res. 2005; 3(2): 663-5.
22. Li Z, Ning C, Dunyuan X, Haiquan L, Yaozu C. Study on chemical constituents of volatile oil of fresh flowers of *Elaeagnus Angustifolia* L. Chem Res Chin Univ. 1989; 10(8): 804-8.
23. Bucur L, Stanciu G, Istudor V. The GC-MS analysis of *Elaeagnus angustfolia* L. flowers essential oil. Chem Nat Compd. 2007; 58(11): 706-9.

How to cite the article: Elmi F, Dehghan Ghr, Beigzadeh B. Qualitative and quantitative changes of essential composition in the flowers of some populations of Elaeagnus angustifolia. Adv Herb Med. 2016; 2(1): 1-6.