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RESEARCH ARTICLE

The effects of altitude on chemical compositions and function of essential oils in *Stachys lavandulifolia* Vahl. (Iran)

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Abstract: Altitude, as one of the environmental factors, makes an impression on function and growth of plants in terrestrial ecosystems. Wood Betony (*Stachys lavandulifolia* Vahl.) belongs to the Lamiaceae family which amply uses in traditional and modern medicine such as treatment of infection, Asthma, and agonal illness, especial rheumatism. The herb is also used as nutrient for the stomach upset, and is effective to reduce the discomposure, the digestive disorders, and the genital tumours and cancer ulcers. The goal of current research was to survey the effects of altitude on the chemical compositions and function of the essential oils in *Stachys lavandulifolia*. Hence, aerial organs of the species were collected in flowering stage and three different altitudes and after shrivelling *in vitro* thermal position, extracting of essence was then done by Hydrodistilation method. Compositions of the essential oils were identified and analysed using GC and GC/MS and by measuring the Retention Index and Mass spectrums. One way ANOVA method was employed to analyse the data set in SPSS v.17 software. Duncan method was also used to grouping of variables. Results showed that efficiency of essence of the species in three altitudes such as 1600, 2400 and 3200 m asl were 0.77±0.01%, 0.61±0.02%, and 0.69±0.007% respectively. The maximum and minimum chemical composition were for 1600 and 2400 m asl altitudes, respectively. In most cases, in the three altitudes, 93 chemical components were identified that the most of them were Hexadecanoic acid, Germacrene D, alpha-Pinene, beta-Myrcene, beta-Pinene and beta-Phellandrene. 1600 m asl was the most desirable altitude to grow species to achieve the optimal quality and quantity of the essential oils.

Keywords: *Stachys lavandulifolia*; essential efficiency; altitude; chemical composition; Iran.

Introduction

Employment of medicinal plants in order to treat is in attendance with life history of the Man and even some cases, it was the only way to remedy the illness so that it can be pointed out that recognition of the medicinal plants went along with knowing of diseases (Djavidtash, 2000). Hence, herbal medicine formed based upon ethnobotanic knowledge from one generation to another (Rouhani and Beygi, 2009). Using of the medicinal plants were abrogated by increasing of synthetic medicines, industrialization of communities and advancement of technologies (Aeineh'chi, 1986; Norouzian and Bashirie Sadr, 2000), and finally disequilibrium between human communities and their requirements (Mahboubi and Fizabadi, 2009). Considering of the medicinal plants and their effective matters was reformed (Samsam Shariat, 2007) because of unfavourable lateral harms of the synthetic compositions, lack of their adaptation to human nature (Shrikumar and Ravi, 2007), their environmental pollutions and expensive prices (Taherian and Soleymani, 2006). The medicinal plants, as one of the important lateral productions of rangelands, have especial performances as they have effective matters and physiologic effects on the other living things (Omidbeygi, 2000). The essential plants are more important because of their aromatic components (Bagheri et al., 2006). These kind plants

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perform extant metabolic actions in their life cycle seral that coherent and harmonic connections in function of chemical enzymes are requirement tools to execute these procedures (Sasson, 1991). Although growth and increment, quality and quantity of the effective matters in the medicinal plants basically are carried out with conduction of genetic processes and hereditary structures (Palevitch, 1987), some environmental factors including altitude, slope, latitude, temperature, sunlight, and relative humid play the important role in metabolism of the medicinal plants and changes of the effective matters' synthesis of them (Omidbeygi, 2000) in order that the factors regarding distribution and phytogeography of plants are caused some changes in growth and increment of the medicinal plants and their quality and quantity of the effective matters (Vagujfalivi, 1968; Yanive and Palevitch, 1982). It has been pointed out that oscillation of the metabolic activities in plants is influenced by different environmental factors (Doroganevskaja, 1953). Hence, the maximum productions of the medicinal plants are obtained regarding to select the desirable condition of the environment, removal time, and herbaceous species (Habibi et al., 2006).

The herbs of Lamiaceae family and some of its types were an area of concern to different researchers in view of identification of essential compositions (Zargari, 1993). Species of this family have globally dispersed (EI- Gazzar & Watsonn, 1970), but they specially gather in Mediterranean areas. *Stachys* genus has more than 270 species and it is one of the richest genera in Lamiaceae family. Thirty four species from this genus exist in the Iran's flora that 13 species of it are endemic in Iran(Lazarevic et al, 2010). Species of *Stachys lavandulifolia* is a plant from Lamiaceae family, with 25 cm height, glaucous stems, wooled inflorescence which has long aromatic yarn, and its body seems green to greyish colour that its flowering period is April to June (Ghahraman, 1994). The most distribution of this species belongs to North America and Europe. It however is seen in southeast of Asia and Middle East as well (Rechinger & Hedge, 1982). Geographic scattering of *Stachys lavandulifolia* species is limited to northern moiety of Iran (Ghahraman, 1994). Abundant of this species is more in shallow slopes, especially in humid area of upland crests (Ghelichnia, 2001). The essence of aerial part of the species is used in the traditional medicine of Iran, including treatment of infection, Asthma, and, and agonal illness, especial rheumatism (Maleki et al, 2001). The herb has been a nutrient for the stomach upset (Babakhanlo et al, 1998) and is effective to reduce the discomposure (Rabbani et al, 2003; 2005), the digestive disorders (Mos'hafi et al, 2009), and the genital tumours and cancer ulcers (Lazarevic et al, 2010), as well.

Researches on the essential oils of *Stachys aleuvites* species from Turkey has showed that basic components of the species were Sesquiterpene as main monoterpene of it was α-Pinene (Guido Flamini et al., 2005). An investigation on the essential oils of seven taxa of *Stachys* genus in Croatia has displayed that sesquiterpene hydrocarbons were the main elements of taxa structurs except *Stachys alpine* and they also was rich by oxygen sesquiterpene (Vjera Bilusic Vundac et al., 2006). Studying of Skaltsa et al. (2003) on the essential oils of eight taxa in *Stachys* genus in Greece has demonstrated that sesquiterpene hydrocarbon was the basic formation of the essence in all species. Researches of Mahzooni et al. (2012) on *Stachys lavandulifolia* in different vegetative regions of Mazandaran province have proved that different components with various rates were found in the essence regarding different area. Investigations on *Thymus* genus were appeared that the altitude (Djamshidi et al, 2006; Habibi et al, 2006; Kazemizadeh et al, 2008), some environmental factors such as soil diversity, weather, the amount of organic matters, texture and calcium rate in soil have the most roles in rate of quality and quantity of the species essence (Saez, 1995; Corticchiato et al, 1998). Mirzaei Kolagari, (2008) The effects of some environmental factors on the effective matters of capsule in *papaver persicum* Lindl. in Rineh area has showed that the percentage of the effective matter differed in various altitudes. The percentage of the effective matter in essence of *Stachys lavandulifolia* in different altitude in Tohe Jaan of Chenaran was differently reported by Sarvari (2009) so that the percentage of effective matter has increased regarding increasing of altitude level.

Uplands of northern Alborz Mt. (Iran) are influenced by local climate and moistureless effects of Mediterranean climate so that the existing humidity is caused to increase the differentiation of vegetation density and percentages. Establishing of the *Stachys lavandulifolia* in the stony and rocky areas is also caused that it is frequently found in these regions. Current research endeavours to find out the different altitude levels' effects on the rate of the effective matter in the essential oil of the species and investigate the climatic effects of the northern Alborz Mt. via various level of altitude on the species.

Material and methods

Collection of the species and extraction of essence

In order to determine the best altitude level in production of the effective matter in essential oil, aerial parts of *Stachys lavandulifolia* were collected in flowering stage, from June to July 2011 in three altitudes such as 1600, 2400, and 3200 m a.s.l in Mazandaran province where is northern Alborz Mt. (Iran). Sampling was done two times and collected plants were dried in vitro condition. As much as 100 gr of the essential oil in the herb's aerial parts extracted using Clevenger instrument with Hydrodistilation method for 3 hours (Demirci et al, 2008; Goncalves et al, 2010). In order for the essential not to be mixed with water, 1 mili-litter of pentane solvent was poured into the store inlet of the essential. Considering the moisture percentage, the essential output was measured in dry weight (w/w). The essential, when extracted, is collected and distilled using Sodium Sulfate, and kept in the fridge at 4˚C. until it was injected into Gas Chromatography (GC) (Vagionas et al, 2007; Ahmadi et al, 2010).

Essential analysis

The extracted essential oil was first injected into the GC. The most suitable programing of thermal column then was obtained for complete separation of the essential oil. In addition, the relative percentage and Deterrence Index of each component was measured. Then, the essential oil was analysed using GC/MS in order to identify its composition. The components were identified using under area of mass spectrometry curve, and were compared with the standard compositions and the data in the mass database Wiley275.L (Adams, 2007).

Characteristics of the instruments used in the study

1) Clevenger apparatus: The experiment used the Clevenger apparatus from Goldis Company in Iran to extract essential from the sample herb.

2) GC and GC/MS: The experiment is employed the N6890 Gas Chromatography (GC) (Agilent Ltd., US), with FID detector (ionisation detector by Hydrogen flame), with HP-5 column in 30 meters length and 0.25 millimetre internal diameter, plus with constant phase layer in 0.25 micron. The conveyer gas was Helium and temperature of injection position was 250^{o}C which in the direction of thermal programing, it is used 50-250^{o}C with increasing 5^{o}C per every minute. In this study, it also used B5975 GC/MS (Agilent Ltd., US), with 70 volt-electron as detector. The employed column in HP-5 was same thermal programing and traits in GC.

Data analysis

In order to compare the percentage of the essential composition of *Stachys lavandulifolia* in three altitude levels of Alborz Mt. (Iran), one-way ANOVA method was employed using SPSS v.17 software. Grouping of three altitude levels was done by Duncan test.

Results

Percentage of the chemical composition in the essence

Comparing of essential compositions percentages in *Stachys lavandulifolia* from three altitude levels showed that maximum rate of the essence referred to altitude 3200 m with 64 components, which formed 97.31 % of the essence, and the least one also referred altitude 1600 m with 47 elements (95.77 % of the essential volume). The altitude 2400, it was 58 components which formed 96.78 % of the essential volume (Table 1). In most cases in the three altitude levels, 93 components were identified that the main elements include Hexadecanoic acid, Germacrene D, alpha-Pinene, beta-Myrcene, beta-Pinene, and beta-Phellandrene.

Table 1: Chemical compositions of the essencial oil of *Stachys lavandulifolia* in the three altitude levels

S.No.	Component name	Composition percentage			Retention Index
		1600	2400	3200	
1	alpha-Thujene	0.58±0.04	1.04±0.03	0.39±0.02	906
2	alpha-Pinene	13.84±0.02	13.71±0.04	8.53±0.03	916
3	beta-Myrcene	7.76±0.01	4.46±0.02	6.37±0.02	918
4	alpha-Phellandrene	0.17±0.04	0.48±0.05	0.4±0.01	963
5	beta-Pinene	6.76±0.03	7.03±0.03	4.73±0.02	979
6	delta 3-carene	-	0.09±0.03	0.15±0.05	986
7	alpha-Terpinene	-	0.26±0.03	0.22±0.04	1003
8	o-Cymene	0.34±0.04	-	-	1010
9	p-Cymene	-	-	0.53±0.04	1011
10	beta-Phellandrene	4.26±0.04	5.66±0.02	3.89±0.02	1016
11	1,8-Cineole	-	0.31±0.03	0.4±0.02	1018
12	cis-Ocimene	2.47±0.04	3.38±0.03	3.26±0.04	1028
13	beta-Ocimene Y	-	0.36±0.02	0.38±0.04	1039
14	gamma-Terpinene	1.005±0.03	0.96±0.03	0.89±0.03	1048
15	Cis-sabinene hydrate	-	0.09±0.04	-	1060
16	Alpha-terpinolene	-	0.18±0.03	-	1080
17	Linalool	-	0.23±0.03	-	1096
18	Camphor	-	-	0.67±0.04	1139
19	Borneol	-	-	1.04±0.04	1163
20	Terpinene-4-ol	-	0.19±0.03	0.38±0.04	1175
21	alpha-Terpineol	-	0.24±0.04	0.19±0.04	1190
22	Chrysanthenyl acetate	-	-	0.16±0.07	1259
23	Bornyl acetate	-	0.09±0.02	0.19±0.01	1283
24	alpha-Copaene	1.45±0.03	-	2.79±0.03	1373
25	alpha-Cubebene	-	2.25±0.03	-	1375
26	beta-Bourbonene	0.63±0.04	0.76±0.04	0.52±0.04	1382
27	beta-Elemene	0.34±0.04	0.81±0.04	0.58±0.04	1389
28	Camphene	0.3±0.02	0.29±0.04	0.43±0.03	1396
29	Caryophyllene	1.25±0.07	1.29±0.04	1.29±0.02	1417
30	beta-Cubebene	0.19±0.03	0.21±0.03	0.26±0.04	1427
31	Zingiberene	0.35±0.04	-	-	1433
32	beta-Farnesene	0.55±0.05	-	-	1454
33	trans-beta-Farnesene	-	0.57±0.04	1.19±0.04	1457
34	Phytane	0.28±0.03	-	-	1458
35	4-Methyldodecane	-	-	0.29±0.05	1460
36	Germacrene D	13.95±0.02	8.93±0.02	14.51±0.02	1483
37	beta-Ionone	-	-	0.2±0.04	1486
38	Bicyclogermacrene	2.83±0.04	2.12±0.02	2.50±0.02	1496
39	alpha-Muurolene	-	-	0.31±0.04	1498
40	germacrene A	0.26±0.04	-	-	1504
41	beta-Bisabolene	0.39±0.01	0.67±0.02	0.93±0.04	1506
42	alpha-Amorphene	0.95±0.04	0.17±0.04	0.67±0.04	1513
43	Bicyclo[4.4.0]dec-1-ene, 2-isopropyl 5-methyl-9-methylene	0.32±0.05	0.39±0.02	-	1516
44	7-epi-alpha-selinene	-	-	1.37±0.04	1517
45	delta-Cadinene	1.52±0.04	1.83±0.02	2.87±0.05	1523
46	Cis-alpha-bisabolene	0.32±0.04	0.67±0.03	0.99±0.05	1540
47	spathulenol	3.2±0.04	3.40±0.04	1.90±0.04	1580
48	Caryophyllene oxide	0.81±0.04	-	-	1585
49	Eremophilene	-	-	0.75±0.05	1587
50	Veridiflorol	-	0.53±0.03	-	1589
51	salvial-4(14)-en-1-one	0.4±0.04	0.48±0.03	-	1595

52	Aromadendrene	0.76±0.04	-	-	1606
53	1,4-Methano-1H-indene, octahydro 1,7-dimethyl-4	-	0.68±0.05	0.88±0.09	1609
54	Tricyclo[5.2.2.0(1,6)]undecan-3-ol 2-methylene-6,8,8-trimethyl	-	-	0.44±0.07	1614
55	Naphthalene, 1,2,3,5,6,7,8,8° octahydro-1,8°-dimethyl-7-(1-methylethenyl)	-	0.10±0.03	-	1621
56	Cadina-1,4-diene	-	-	0.28±0.03	1629
57	1H-Cycloprop[e]azulene, decahydro-1,1,7-trimethyl-4-methylene	-	0.26±0.03	-	1630
58	gamma-Cadinene	1.12±0.04	0.48±0.04	-	1644
59	alpha-Cadinol	1.01±0.03	2.67±0.04	2.11±0.06	1647
60	beta-Eudesmol	-	-	0.77±0.06	1653
61	valencene	0.31±0.03	0.29±0.04	0.76±0.05	1656
62	t-Muurolol	-	-	2.27±0.02	1657
63	gamma-Gurjunene	0.54±0.04	-	-	1661
64	beta-Maaliene	-	-	0.6±0.05	1663
65	Elemol	-	-	0.35±0.04	1669
66	1,1,4,4-Tetramethyl-2-tetralone	0.88±0.04	1.17±0.04	1.67±0.02	1676
67	Anymol	0.82±0.04	0.55±0.007	-	1684
68	Levomenol	-	-	2.03±0.04	1685
69	Dehydroaromadendrene	-	-	1.01±0.01	1689
70	IsoCaryophyllene	-	2.22±0.04	-	1699
71	4-Bromo-1-naphthalenamine	-	0.05±0.02	-	1723
72	Tetradecanoic acid	0.99±0.04	0.51±0.05	0.29±0.03	1770
73	Benzaldehyde, 2,3,4,5-tetramethyl	-	-	0.45±0.05	1811
74	2-Pentadecanone, 6,10,14-trimethyl	2.50±0.03	1.35±0.02	1.97±0.05	1842
75	PalatinolIC	0.21±0.03	0.35±0.04	0.49±0.09	1868
76	Hexadecanoic acid	15.37±0.02	13.97±0.01	9.4±0.01	1981
77	Octadecanoic acid	0.27±0.04	-	-	1990
78	Sclarene	-	-	0.47±0.07	1992
79	Heptadecanoic acid	-	0.24±0.06	-	2074
80	Phytol	0.91±0.03	1.12±0.04	0.8±0.05	2109
81	Linoleic acid	0.43±0.04	2.58±0.04	0.39±0.06	2138
82	9-Octadecenoic acid	-	-	0.23±0.04	2142
83	9,12,15-Octadecatrien-1-ol	-	-	0.37±0.007	2144
84	Methyl linolenate	1.11±0.04	-	-	2146
85	4,2,8-Ethanylylidene-2H-1-benzopyran, octahydro-4-methyl	-	-	0.47±0.04	2150
86	Tricosane	0.22±0.04	-	-	2291
87	Eicosane	-	0.08±0.01	-	2292
88	Heptadecane	0.30±0.04	-	-	2491
89	Pentacosane	-	0.44±0.04	0.28±0.02	2493
90	Compound 889	-	0.25±0.07	-	2545
91	Heptacosane	-	1.28±0.05	0.83±0.05	2689
92	Tetracosane	0.55±0.04	0.75±0.04	0.58±0.04	2889
93	Octadecane	-	1.26±0.04	-	2896
	Total percentage of components	**95.77**	**96.78**	**97.31**	**-**

Efficiency of the essence

The average of the essential efficiency in *Stachys lavandulifolia* in altitudes 1600, 2400, and 3200 m were respectively 0.77±0.01%, 0.61±0.02%, and 0.69±0.007% that the altitudes 1600 and 2400 m had the most and the least efficiency of the essence (Table 2, Fig. 1). Regarding the obtained result from ANOVA table, the effects of altitude from sea level on the essential efficiency was significant (P<0.01). Grouping of means by Duncan test has also showed that the maximum essential efficiency referred to altitude 1600 m and the least one to 2500 m level (Fig. 1).

Table 2: ANOVA result for the three altitude effects on common compositions percentages of essential oil in *Stachys lavandulifolia*.

Components name	F statistics
Essential output	51.500**
alpha-Pinene	14270.273**
beta-Myrcene	9150.111**
beta-Phellandrene	1725.098**
beta-Pinene	2887.015**
Germacrene D	27582.59**
Hexadecanoic acid	68893.588**

** $P_{value} < 0.01$

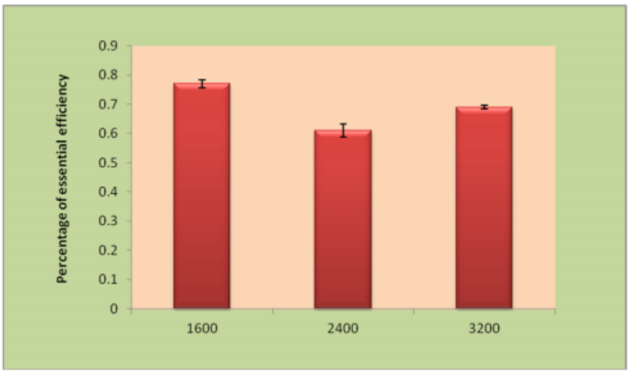

Figure 1: The average of the essential efficiency in *Stachys lavandulifolia* from three altitudes.

Secondary medicinal components

In regard to achieved result from ANOVA table 3, the altitude effects on common and main components of the essential oil in *Stachys lavandulifolia* were signified in P<0.01 level. In current research's analysis, the percentage of alpha-Pinene component has swayed between 8.53±0.03 % and 13.84±0.02 % and comparing of the mean by Duncan test has also showed that alpha-Pinene percentage is divided into three groups (Table 3) which the first level (1600 m) is in the highest ranks. Beta-Myrcene is one of the main components in the species that grouping of it showed that the most level of beta-Myrcene is in the first level of altitude (1600 m). The components of beta-Phellandrene (3.89±0.02% - 5.66±0.02%) and beta-Pinene (4.73±0.02 – 7.03±0.03%) were swayed in different altitude, but the Duncan test showed that both of them were the highest level in the altitude 2400 m (P<0.01). Another element was Germacrene D which had 8.93±0.02% to 14.51±0.02% in various altitudes. The Duncan test of this component showed that it was the maximum level in the altitude 3200 m. The highest and most basic elements in the species refer to Hexadecanoic acid which swayed between 9.4±0.01 to 15.37±0.02% in different altitudes and the Duncan test of the element showed that the maximum and least of this element were in the altitude 1600 and 3200 m, respectively.

Table 3: comparing of the means from efficiency and common components in *Stachys lavandulifolia* from three altitude levels.

Altitudes	number of components	total percentage of components	Essential output	Hexadecanoic acid	Germacrene D	beta-Pinene	beta-Phellandrene	beta-Myrcene	alpha-Pinene
1600	47	95.77	0.77±0.01a	15.37±0.02a	13.95±0.02b	6.76±0.03b	4.26±0.04b	7.76±0.01a	13.84±0.02a
2400	58	96.78	0.61±0.02c	13.97±0.01b	8.93±0.02 c	7.03±0.03a	5.66±0.02a	4.46±0.02c	13.71±0.04b
3200	64	97.31	0.69±0.00b	9.4±0.01c	14.51±0.02a	4.73±0.02c	3.89±0.02c	6.37±0.02b	8.53±0.03c

a, *b*, and *c* alphabets show the group division that *a* is the most and *c* is the least level.

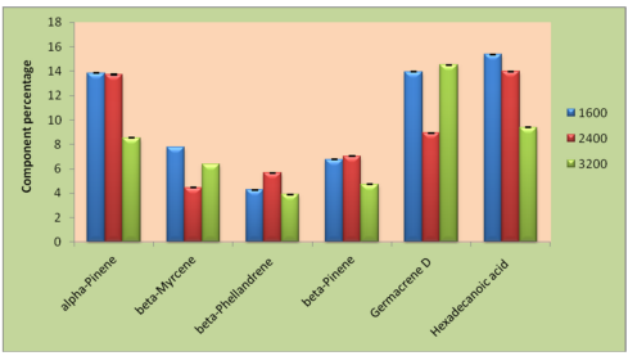

Figure 2: The effects of three altitude levels on common composition percentages of essential oil from *Stachys lavandulifolia* species

Discussion

Of important factors in changing of ecosystems conditions are the altitude from sea level so that increasing or decreasing of the altitude level can change the temperature, relative humidity, wind speed, available water to plants' roots, and the sunlight rates. Hence, regarding the altitudinal level changes, ecophysiological reactions of plants will also change. *Stachys lavandulifolia* is a plant which is influenced by edaphic factors, climate, and geologic formation, as well. So that it is seen in steep slope and debris formations or on cliff formations where can be occupied by few species. Therefore, it is expectation that the rate of essence and component diversity will also change regarding changes of ecologic niches' circumstances, in order that from 93 identified elements in the essential oils of the species, monoterpene components were the main composition of the plant. These elements have many usages in medicinal and food industries, for instance, treatment of infection (Maleki et al., 2001), the digestive disorders (Mos'hafi et al, 2009). As the monoterpene and sesquiterpene hydrocarbons were the main components of the species, the obtained results according to reports of some researches such as Guido et al. (2005) on *Stachys aleuvites*, Vjera Bilusic Vundac et al. (2006) on seven taxa of *Stachys* genus, Skaltsa et al. (2003) on analysis of eight taxa of *Stachys* genus, and Mahzooni et al. (2012) on *Stachys lavandulifolia*. However, with a view to the percentages of essence components in the three altitude levels of the species did not match to the others as it influenced by microedaphic and microtopographic conditions. Because the species has been found on alluvial rocky formation with shale, conglomerate, sandstone, and sometimes on altered calcareous originates. Hence, the role of environmental factors on the plant ecophysiology was precisely observed.

As it can be seen in the result section, rising of altitudinal levels has increased the number of components and total percentages of the essential composition and the statistical comparison has also showed the altitude effects on the percentages of essence in 1% probability level. Albeit the effects of altitude on the species essences were reported by other researches such as Sarvari (2009) on *Stachys lavandulifolia* and Habibi et al (2006) on *Thymus kotschyanus*, but the climatic condition in the study area was the main increasing reason. This area has a sort of dry-cool climate on the basis of Emberger's method. The area locates on central Alborz zone where is in connect with central Iran's climate because of cross section of this area toward to central Iran's climate which allows it to elongate to the area (Jouri, 2010). Hence, the condition of coldness and dryness climate in the area is ecophysiologically changed the species height and increased the rate of the essential oils.

Based upon results, the highest percentage of essential efficiency was found in 1600 m and statistical comparison of this matter has also shown that the essential percentage from this altitude level was the maximum level than the others. It is known that from down to up altitudes, the essential percentages will be decreased as the total rate of essential components will be increased. This result is confirmed by the report of other researchers, such as Djamshidi et al (2006) who have pointed out that in regard to increase the altitudinal level, the rate of essential efficiency was decreased in *Thymus kotschyanus*. The first level altitude of the study area apropos of upland altitudes, however, has enough soil and atmosphere moistures as its climate is cool-humid based upon Emberger's method (Jouri, 2010). Therefore, the down altitude has more essential efficiency than the others.

Although the Hexadecanoic acid wad the main component in all ranges, some components were just found in an altitudinal level, as for example, Borneol, t-Muurolol, and Levomenol were in 3200 m, alpha-Cubebene and IsoCaryophyllene were in 2400 m, and finally Methyl linolenate and Caryophyllene oxide were in 1600 m. In addition the effects of climatic circumstances, the environmental condition had also increased the Hexadecanoic acid. The altitudinal level of 1600 m belongs to livestock grazing area in all seasons except winter period. Hence, the acid, as sebaceous acid, will be increased by animal excreta and their indirect effects on growth of the species. Moreover, it increased the silt of soil in this altitudinal level as well. Regarding this cases, Saez (1995) has revealed that some organic components and primary essences of *Thymus hyemalis* were influenced by environmental factors. Kazemizadeh et al (2008) have also reported that the ecological condition of vegetative regions influenced on quality and quantity of aerial organs' essential components in *Teucrium hyrcanicum* in different altitudinal levels.

Conclusion

With relation to results and field observations, the maximum essential efficiency belongs to 1600 m level where many rural buildings exist there. Hence, the villagers traditionally use the species without any ecological notations. Therefore, it is recommended that ecologic management can provide the conditions which around the villages are planted by the species and via this approach, economic incomes of villagers will be increased.

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