World Journal of Environmental Biosciences
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Available Online at: **www.environmentaljournals.org**

Volume7, Issue 2: 79-84

ISSN 2277- 8047

Essential Oils of *Bellis Sylvestris, Asteriscus Maritimus and Artemisia Campestris* Stems Growing in Different Areas in Algeria

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ABSTRACT

The chemical composition of the essential oils hydrodistillated from stems of Bellis sylvestris, Asteriscus maritimus and Artemisia campestris collected from different areas from Algeria, was analyzed by (GC.MS). In total, 52, 62 and 59 chemical compounds were identified in the essential oils. The essential oils represented 84.3%, 82.3 %, and 83.6% of the total oil composition in stems, respectively. The results showed that the major components from Bellis sylvestris stems were found to be: Azuleno(2,1-b) thiophen-3(2H)-one (27.2), Phenoxathiin (16.3%), Pentacosane (5.7%), α-Naphthoquinone (4,8 %). Whereas in Asteriscus maritimus stems, the major components were γ-Eudesmol (17.4%), 2-Naphthaleneac etaldehyde, 1,4-dihydro-α, α-dimethyl-1,4-dioxo- (5.9%), Humulane-1,6-dien-3-ol (5.1%), and Isolongifolene, 7,8-dehydro-8a-hydroxy- (4.5%). And in Artemisia campestris stems, the major components were 2-Naphthaleneac etaldehyde, 1,4-dihydro-α, α-dimethyl-1,4-dioxo- (22,1%), Falcarinol (12 %), γ-Muurolene (4.6%) and Pentacosane (4.3%).

Keywords: *Bellis Sylvestris, Asteriscus Maritimus, Artemisia Campestris, Asteraceae, Essential Oil, Stems.*

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Received: 23 December 2017
Accepted: 25 March 2018

1. INTRODUCTION

Climatic conditions, the growth region's geographic position, agro-technology of growing, as well as the vegetation stage of the plants at the time of harvesting, and also the applied extraction technique, affect both the qualitative composition and the contents of the individual components of the isolated essential oils (Telci et al., 2006, Voitkevich, 1999). The essential oils have been famous for having numerous important ecological contributions like protection against predators (microorganisms; fungi; insects; herbivores), against UV radiations but they may also serve secondary functions of attracting the natural enemies of these herbivores, attracting pollinators and dispersing diasopres, inhibiting germination and growth, etc. (Kessler & Baldwin, 2001). Therefore, essential oils and plant extracts are auspicious new sources of natural substitutes to chemical drugs (Rahman et al., 2011). Essential oil bearing plants have been taken into consideration as natural sources for flavour, fragrance, food and pharmaceutical industries, because of their considerable aromatic and antimicrobial characteristics (Edris, 2007; Kalemba & Kunicka, 2003; Janssen et al., 1987). The genus *Bellis* (Asteraceae), includes about ten species, all of which are small annual or perennial herbs (Burt, 2004). *Bellis sylvestris*, the southern daisy, is an official and edible plant. It is more prevalently used comparing to another plant of the same genus, *Bellis perennis*. Young leaves are used in making salad, while leaf and flowers are known for their diuretic, purgative and diaphoretic characteristics (Calvo et al., 2012). They also possess anti-inflammatory and astringent characteristics and have been utilized to cure common cold and infections of the upper respiratory tract in folk medicine (Karakas et al., 2012). Previous studies on *Bellis sylvestris*, led to the isolation of triterpenoid saponins (Çakılcıoğlu et al., 2010). One of flavonoids phenolic acids (Scognamiglio et al., 2012a) was reported for the first time, and the bacterial strains of these acids showed variable degrees of susceptibility to the compounds (Scognamiglio et al., 2016). Also, the composition of essential oils from various species of *Bellis* has been investigated by many authors namely: *B. perennis,* and *Asteriscus maritimus* (L.).

Asteriscus maritimus LESS. which belongs to the family of the *Asteraceae*, is one of the five *Asteriscus* species growing in Algeria; *A. graveolens* (FORSSK.) LESS., *A. aquaticus* (L.) LESS., *A. maritimus* (L.) LESS., *A. pygmaeus* COSS. et KRAL, and *A. spinosus* G.G. (Quezel & Santa, 1963; Ozenda 2004). *A. graveolens* (FORSSK.) LESS. is a synonym for *Bubonium graveolens, Odontospermum graveolens,* or *Nauplius graveolens* (Quezel & Santa 1963; Ozenda 2004). The genus *Asteriscus* contains *sesquiterpenes* flavonoids and essential oils (Medimagh et al., 2012; Palá-Paúl J et al., 2014; Chaib et al., 2017).

The genus *Artemisia* L. is among the largest and the most widely distributed genera of the family of Asteraceae (Compositae). It is a heterogeneous genus, including about 400 species distributed in the Mediterranean region, Northern Africa, Western Asia and Southwestern Europe, and Arabian Peninsula (Al Snafi, 2013). *Artemisia* is represented by 13 species in the Algerian flora (Ozenda, 2004). Among them, *Artemisia campestris* L., widespread in the steppe and south of Algeria, commonly known as field wormwood or field sagewort locally known as "T'gouft", ''dgouft'' or armoise rouge, is one of the common species of this genus used as decoction for its anti-inflammatory, antirheumatic, antivenom and antibacterial activities (Benli et al., 2007). The aerial part of this plant is used in common medicine as anthelmintic, antiseptic, cholagogue, deobstruent, emmenagogue, stomachic, tonic, hypotensive and antivenin (Dob et al., 2005).

In this study, it was aimed to determine the chemical composition and relative amount of *Bellis sylvestris*, *Asteriscus maritimus* and *Artemisia campestris* essential oil prepared from the stems by GC-MS, and the antimicrobial activity of the essential oil was evaluated by disc diffusion against some tested Gram positive and Gram negative bacteria, and also some Fungi.

2. MATERIALS AND METHODS

Plant materiel

The stems of *B. sylvestris, A. maritimus* and *A. campestris* were collected in flowering stage from Batna semi-arid region (*B. sylvestris* and *A. campestris*) and ElKala humid region (*A. maritimus*) region of Algeria during 2013, and identified by Abdeslam Grira (Tha National Park, El Kala). Voucher samples were deposited in biomolecules and plant breeding laboratory, University of Larbi Ben M'hidi, Oum Elbouaghi, Algeria under number ZA200, ZA201, ZA202, respectively. The plants under investigation were air-dried, powdered and kept in tightly closed amber colored containers.

Extraction of plant material

Dried stems (100 g) were extracted by hydro-distillation using a Clevenger type apparatus for 3 hours. The essential oils were collected, dried over anhydrous sodium sulfate (Na_2SO_4), and then stored in sealed vials at -18 ºC, for the GCMS analyses.

Gas chromatography – Mass spectrometry

The qualification of the essential oil (1mg) diluted in diethyl ether (EtO2) (1ml) was analyzed on a Finnigan-MAT 8200 Mass Spectrometer coupled with a Hewlett-Packard GC- 5890II series GC by using an SE-54 fused silica capillary column (30 m x0.25 mm i.d.; 0.25 μ m film thickness). Helium (He), having a flow rate of 1.15 mL/min, was used as a carrier gas. The temperature of GC oven was maintained at 60 °C for 5 min, and programmed to 260 °C at a rate of 2 °C/min, and then maintained at 260 °C. The injector temperature was 250 °C. The amount of injection was 1 μ L. A constant pressure of 5 kg/cm2 was used while the carrier gas was delivered. MS spectra were considered at El ion source of 70 eV. The split ratio was 1:5. The retention indices for all the constituents were identified based on the Van Den Dool method (Dool & Kratz, 1963) using those of internal (computer) libraries, NIST libraries and some reference compounds, and also those described by (Adams 1995, 2001).

3. RESULTS AND DISCUSSION

Chemical composition of the essential oils

The oil yield varied in the three species from 0. 1 % of the lowest value of the *A. maritimus* to the highest values of the B. *sylvestris* and *A. campestris* (0. 6 % and 0. 7 %, respectively). The GC/MS analysis permitted the identification of 52, 62 and 59 components in the essential oils of *Bellis sylvestris*, *Asteriscus maritimus and Artemisia campestris* respectively. Essential oils represented 84.3%, 82.3 %, and 83.6% of the total oil composition in stems, respectively. The main constituents of *Bellis sylvestris* oil and stems were: Azuleno(2,1-b)thiophen-3(2H)-one (27.2), Phenoxathiin (16.3%), Pentacosane (5.7%), α-Naphthoquinone (4.8 %). Whereas in *Asteriscus maritimus stems,* the main components were *γ*-Eudesmol (17.4%), 2-Naphthaleneac etaldehyde, 1,4-dihydro-α, α-dimethyl-1,4-dioxo- (5.9%), Humulane-1,6-dien-3-ol (5.1%), and Isolongifolene, 7,8-dehydro-8a-hydroxy- (4.5%). And in *Artemisia campestris stems,* the main constituents were 2-Naphthaleneac etaldehyde, 1,4-dihydro-α, α-dimethyl-1,4-dioxo- (22.1%), Falcarinol (12 %), γ-Muurolene (4.6%) and Pentacosane (4.3%).

The chemical compositions of the three oils are given in Table 1.

In general, many variations have been found in the chemical compositions of the three oils. These variations in the main constituents can be explained by the influence of the species. Furthermore, the literature has shown the lack of research concerning the ethno-pharmacology, volatile oil composition of *B. sylvestris. A. maritimus* oil was particularly rich in γ-Eudesmol (17.4 %), 2-Naphthaleneac etaldehyde, 1,4-dihydro-α, α-dimethyl-1,4-dioxo- (5.9%), Humulane-1,6-dien-3-ol (5.1%). Essential oils of stems from other countries have been reported to possess different chemical compounds, Medimagh et al. 2012 showed that stems' oil was very rich on Hexdecanoic acid 46.39% and phytol 15.57. Additionally, in comparison with other species, Chaib et al. (2017) identified that the major components of *A. vulgaris* aerial parts were cis-Chrysanthenyl acetate 31.1, Myrtenyl acetate 15.1, Kessane 11.5. These variations in the main constituents reported in the literature can be explained by the influence of environmental and methodological factors (Bakkali et al., 2008).

However, myrtenyl acetate (44.2%), terphenyl (17.5%), *(Z)-β-*farnesene (12.9%), myrtenol (5%) and terpinen-4-ol (4.5%)

were represented as the major components in *A. maritimus* aerial part oil extracted in Italy (Fraternale et al., 2001).

The composition of the volatile oil in *A. campestris* varied widely according to the geographical location, climate, day length and soil type. (Judzentiene et al., 2010) showed that essential oils of *A. campestris* from Mediterranean countries possessed different chemical patterns and differences in the relative quantity of chemical compounds in the EO. The main constituents registered in the aerial parts were: *ar*-curcumene, caryophyllene oxide, *p*-cymene, β-pinene and germacrene D bicyclogermacrene and myrcene in Italy, but in French, they were γ-terpinene, capillene, 1-phenyl-2,4-pentadiyne and spathulenol. In Portugal, the main components were β-pinene, cadin-4-en-7-ol, γ-terpinene (*Z*)-β-ocimene, aromadendrene. In Tunisia, β-pinene, *p*-cymene, α-terpinene, limonene and myrcene were found to be the main constituents, and finally in Algeria, the aerial parts were found to contain **(***Z*, *E*)-farnesol, cedrol and verbenone. In fact, the study on the oil stems is very few, α-pinene and spathulenol were reported as the major components of stem oil from *A. campestris* growing in Iran (Kazemi et al., 2009). In fact, the results of this study agreed with (Lis and Kowal, 2015) from Poland who presented falcarinol as the major component of the stem oil from *A. campestris*.

4. CONCLUSION

The identified components of *A. campestris* showed qualitative and quantitative differences of this oil and other samples from litwania. The main chemical profile was characterized by the predominance of germacrene D, spathulenol, humulene epoxide II, and caryophyllene oxide (Judzentiene & Budiene, 2014).

Table1: Chemical composition of volatile oil from *Bellis sylvestris, Asteriscus maritimus and Artemisia campestris* Stems

Pic N°	Rt	Compounds	*B. sylvstris*	*A. maritimus*	*A. campestris*
1	18.479	Decanal		0.4	
2	23.291	Terpinyl acetate		2.5	0.4
3	24.113	2H-2,4a-Ethanonaphthalene, 1,3,4,5,6, 7-hexahydro-2, 5,5-trimethyl-		0.5	
4	24.245	Cadinene		1.9	
5	24.399	Pent-1-yn-3-ene, 4-methyl-3-phenyl-			0.5
6	25.001	(-)-Tricyclo[6,2,1,0 (4,11)]undec-5-ene, 1,5,9,9-tetramethyl-(isocaryophyll ene-I1)		0.3	
7	25.353	α-Guaiene		0.4	
8	25.411	1,4-Dimethoxy-2-tert-butylbenzene		1	
9	27.032	α-Curcumene	0.5		0.3
10	27.098	Isocaryophillene	0.4		0.3
11	27.355	Valencene	2.1		
12	27.517	Cycloheptasiloxane, tetradecamethyl-	0.5	0.5	0.3
13	27.766	α-Caryophyllene alcohol		0.8	
14	27.869	Diepi-α-cedrene epoxide		1	
15	27.986	α-Panasinsenes	0.4		
16	28.25	Epiglobulol		2.3	
17	28.543	cis-α-Bisabolene	0.2		
18	28.954	Methyl 4-tert-butyl-thiobenzoate		0.6	
19	29.035	,±-trans-Nerolidol			0.6
20	29.416	Isolongifolene, 7,8-dehydro-8a-hydroxy-		**4.5**	
21	29.46	(-)-Spathulenol	0.5		0.4
22	29.614	Caryophyllene oxide			0.4
23	29.629	Globulol		2.1	
24	29.861	Ethyl iso-allocholate	0.3		0.4
25	29.871	Tetradecane, 2, 6,10-trimethyl-		0.5	
26	29.945	Anisole, o-octyl-		0.4	
27	30.275	Calarene epoxide		0.4	
28	30.766	Humulane-1,6-dien-3-ol		**5.1**	
29	30.795	γ-Muurolene			**4.6**
30	31.155	α-Guaiene		0.5	0.5
31	31.566	Hexadecamethyl-cyclooctasioxane	0.4	0.9	0.5
32	31.639	17-Pentatriacontene	0.2		2.3
33	31.888	α-Bisabolol	1		0.7
34	31.903	1H-Inden-1-ol, 2,4,5,6,7,7a-hexahydro-4,4, 7a-trimethyl-		1.4	
35	32.021	γ-Eudesmol		**17.4**	
36	32.16	Salsoline		0.5	

37	32.497	Tetradecanal	0.2	0.4	
38	32.607	9α-Acetoxy-3,5, 8-trimethyltricyclo [6,3,1,0(1, 5)]dodec-2-ene		0.3	
39	33.121	Phorbol			0.4
40	33.275	Octanal, 2-(phenylmethyle ne)-		0.3	
41	33.311	Azuleno(2,1-b)thiophen-3(2H)-one	**27.2**		
42	33.752	Himachalene	0.3		
43	33.942	9H-Fluorene, 9-methyl-		0.6	
44	34.023	Benzene, 1-methyl-3,5-bis[(trimethylsily l)oxy]-	0.6	1.1	0.7
45	34.478	Phosphorin, 2,4, 6-tris(1,1-dimethylethyl)-		0.4	
46	34.852	2-Naphthaleneac etaldehyde, 1,4-dihydro-α,α-dimethyl-1,4-dioxo-	0.2	**5.9**	**22.1**
47	34.867	Phenoxathiin	**16.3**		
48	35.255	Hexahydrofarnesyl acetone		1	
49	35.27	2-Pentadecanone, 6,10,14-trimethyl-	0.6		
50	35.769	Diisobutylphthalat	1.1	1.2	0.4
51	35.96	1-Hexadecanol		0.4	
53	36.172	Octahydroanthracene	0.5	1.1	
54	36.187	6,8-Difluoro-2,2, 4,4,6,7,7,8,9,9-decamethyl-[1, 3,5,2,4,6,7,8, 9]trioxahexasil onane			0.5
55	36.356	Eicosane	0.3	0.3	
56	36.715	1-Hexen, 2-(p-anisyl)-5-methyl-		0.4	
57	36.803	Benzofuran, 4, 7-dimethyl-	0.3	0.7	
58	37.544	n-Hexadecanoic acid	1.3		
59	37.61	Dibutyl phthalate	1.8	0.7	
60	38.292	Eicosane, 10-methyl-	0.3		
61	38.476	2-(1-Methyl-1,2, 3,4-tetrahydro-isoquinolin-1-yl)-propan-2-ol		0.5	
62	38.864	Falcarinol			**12**
63	38.696	Oxirane, heptadecyl-	0.5		
64	39.847	n-Heptadecanol-1	0.2		
65	38.945	Propanoic acid, 2-methyl-, 2-[3-[(acetyloxy)methyl]oxiranyl]-5-methylphenyl ester		0.8	
66	40.163	Heneicosane	0.3	0.5	
67	40.405	Phytol	0.4	0.4	
68	40.544	3(2H)-Benzofuranone, 4,7-dimethyl-		1.3	
69	40.566	Hexadecanal	0.3		
70	40.838	Propanoic acid, 2-(3-acetoxy-4, 4,14-trimethylandros t-8-en-17-yl)-			0.3
71	41.278	Pentacosane	**5.7**		4.3
72	44.117	Lanosta-7, 9(11),20-triene-3β,18-diol, diacetate			0.4
73	41.285	Triacontane		1.2	
74	41.718	11α-Hydroxyprogesterone	0.3		0.6
75	41.923	docosane	0.4		0.5
76	41.931	Octadecane, 3-ethyl-5-(2-ethylbutyl)-			0.5
77	42.371	Octadecanal	**4.1**	0.5	1.2
78	42.694	5,8,11-Eicosatriynoic acid, methyl ester			0.9
79	43.075	Acetyl tributyl citrate	0.4		
80	43.412	Eicosanol	0.5		
81	43.42	1-Eicosanol			0.4
82	43.625	Heptadecane, 9-hexyl-			0.4
83	43.632	Tetracosane		0.5	
84	44.087	Hexadecanal		0.4	
85	44.168	Estradiol	0.3		
86	44.388	2,3,6-Trimethylnaphthoquinone	0.6		
87	44.549	4-β-Phorbol	1.3		
88	44.557	spheroidenone		0.6	0.5
89	45.011	α-Naphthoquinone	**4.8**		

90	45.048	9-Desoxy-9x-chloroingol 3,7, 8,12-tetraacetate			0.3
91	45.254	Tetratetracontane		0.6	2.2
92	45.576	16α,17α-Epoxypregnenolone			0.3
93	45.738	Oxirane, tetradecyl-	0.6	1.8	1
94	46.082	Lanosta-7, 9(11),20(22)-triene-3 β,18-diol, diacetate			0.3
95	46.339	Lanosta-7, 9(11)-diene-3 β, 18,20-triol, 3,18-diacetate, (20R)-			0.4
96	46.398	Ingenol triacetate			0.4
97	46.831	Hexacosane	1	1.3	0.6
98	47.351	Nonacosane	0.2		
99	47.484	Pentatriacontane			2.6
100	47.608	Diisooctyl phthalate	0.3		
101	47.924	Cyclodecasiloxane, eicosamethyl-	0.3		0.4
102	48.342	Octadecane		1.1	0.8
103	48.679	15,17,19,21-Hexatriacontatetrayne			0.7
104	48.848	Hentriacontane		0.5	0.5
105	48.995	Androst-4-en-6-one, 3,17-diacetoxy-			0.5
106	49.097	9,19-Cyclolanost-24-ene-3,26-diol, diacetate			0.5
107	49.259	Gedunin			0.3
108	49.398	Flurandrenolide		1.4	0.4
109	49.405	Eicosane, 10-heptyl-10-octyl-	0.2		
110	49.611	Oleic acid, 3-(octadecyloxy) propyl ester	0.8		0.8
111	49.794	Hexatriacontane	1.4	0.5	1.2
112	49.802	Triacontane		2.2	
113	49.941	1,3-Dichloro-1, 3-bis(norbornadi en-2-yl)-1,3-bis(3-trimethylsilylpr opyl)disiloxane			0.3
114	50.029	Octasiloxane, 1, 1,3,3,5,5,7,7,9, 9,11,11,13,13, 15,15-hexadecamethyl-			0.8
115	50.278	Octadecane, 1, 1'-[1,3-propanediylbis (oxy)]bis-	0.4	0.6	0.7
116	50.330	1,8,15,22-Tetraaza-2,7,16, 21-cyclooctacosa netetrone			0.3
117	50.440	Cholestane, 3,5-dichloro-6-nitro-, (3β,5α,6β)-			0.3
118	50.645	Hexa-t-butylselenatrisiletane			0.5
119	50.667	Cholic acid			0.3
120	50.696	Octadecane,3-ethyl-5-(2-ethyl)		0.4	
121	50.836	Tetratriacontane			3.7
122	50.887	Cyclotrisiloxane, 2,4,6-trimethyl-2,4,6-triphenyl-		1.6	
123	51.107	Lanosta-7,9(11),20-triene-3beta,18-diol, diacetate	0.2		
124	51.115	Thymol blue		0.6	0.6
125	51.202	Heptacosane	0.8		1.8
126	51.217	Octacosane		1.6	
127	51.694	Tetrapentacontane, 1,54-dibromo-	0.5	0.7	2.3
		Total	**84.3**	**82.3**	**83.6**

REFERENCES

1. Adams, R. P., (1995). Identification of Essential Oil Components by Gas Chromatography–Mass Spectroscopy. Allured Publishing., Carol Stream., IL., USA.
2. Adams, R.P., (2001). Identification of Essential Oil Components by Gas Chromatography/Quadrupole Mass Spectroscopy. Allured Publishing Corporation., Carol Stream., IL., USA
3. Al Snafi, A. E. (2013). Encyclopedia of the constituents and pharmacological effects of Iraqi medicinal plants. (Vol 4)., Thiqar University.
4. Bakkali, F., Averbeck, S., Averbeck, D., (2008). Idaomar M Biological effects of essential oils. Food Chem Toxicol 46: 446–475.
5. Benli, M., Kaya, I., Yigit, N., (2007), Screening antimicrobial activity of various extracts of Artemisia dracunculus L. Cell Biochem Funct 25: 681- 686.
6. Burt, S., (2004) Essential oils: their antibacterial properties and potential applications in foods. Int J Food Microbiol 94: 223-253.
7. Çakılcıoğlu, U., Şengün, M, T., Türkoğlu, I., (2010) An ethnobotanical survey of medicinal plants of

Yazıkonak and Yurtbası districts of Elazığ province., Turkey. J Med Plant Res 4: 567-572.

8. Calvo, J., Quintanar A, Aedo C (2012) Typification of four species names of Bellis (Compositae). Nord J Bot 30: 668-670.
9. Chaib, F., Allali, H., Bennaceur, M., Flaminic, G., (2017). Chemical Composition and Antimicrobial Activity of Essential Oils from the Aerial Parts of Asteriscus graveolens (Forssk.) Less. and Pulicaria incisa (LAM.) DC.: Two Asteraceae Herbs Growing Wild in the Hoggar. Chem Biodiversity 14: 8.
10. Dob, T., Dahmane, D., Berramdane, T., Chelghoum, C., (2005). Chemical composition of the essential oil of Artemisia campestris L. from Algeria. Pharm Biol 43: 512-514.
11. Dool., V.D., Kratz, P.D., (1963). A generalization of the retention index system including linear temperature programmed gas-liquid partition chromatography. J Chromatogr 11: 463-471.
12. Edris, A. E., (2007). Pharmaceutical and therapeutic potentials of essential oils and their individual volatile constituents. Phytother Res 21: 308-323.
13. Fraternale, D., Giamperi, L., Ricci, D., Manunta, A., (2001) Rivista Italiana eppos thirty 33-39.
14. Janssen, A. M., Scheffer, J.J.C., Svendsen, A.B., (1987). Antimicrobial activity of essential oils: 1976–86 literature review. Aspects of the test method. Planta Med 53: 395-398.
15. Judzentiene, A., Budiene, J., (2014). Variability of Artemisia campestris L. essential oils from Lithuania. J Ess Oil Res 26: 328–333.
16. Judzentiene, A., Budiene, J., Butkiene, R., Kupcinskiene, E., Laffont-Schwobc, I., Masotti, V., (2010). Caryophyllene Oxide-rich Essential Oils of Lithuanian Artemisia campestris ssp. campestris and Their Toxicity. Nat Prod Commun 5: 1981-1984.
17. Kalemba, D., Kunicka, A., (2003). Antibacterial and antifungal properties of essential oils. Curr Med Chem 10: 813-829.
18. Karakas, F, P., Karakas, A., Boran, Ç., Türker, A. U., Yalçin, F. N., Bilensoy, E., (2012) The evaluation of topical administration of Bellis perennis fraction on circular excision wound healing in Wistar albino rats. Pharm Biol 50: 1031-1037.
19. Kazemi, M., Tabatabaei-Anaraki, M., Rustaiyan, A., Motevalizadeh, A., Masoudi, S., (2009). Chemical composition of the essential oils obtained from the flower., leaf and stem of Artemisia campestris L. from Iran. J Ess Oil Res 21: 197-199.
20. Kessler, A., Baldwin, T., (2001). Defensive function of herbivore-induced plant volatile emissions in nature. Science 291: 2141-2144.
21. Lis, A., Kowal, M., (2015). Constituents of the essential oils from different organs of Artemisia campestris L. subsp. Campestris. J Ess Oil Res 27: 545-550.
22. Medimagh, S., Daami-Remadi, M., Jabnoun-Khiareddine, H., Ben Jannet, H., Hamza, M. A., (2012). Chemical composition., Antimicrobial and antiacetylcholinesterase activities of essential oils from the Tunisian Asteriscus maritimus (L.) Less. Med J Chem 2: 459-470.
23. Ozenda, P., (2004). Flore et végétation du Sahara. (3rd Edtn)., CNRS., Paris.
24. Palá-Paúl, J., Usano-Alemany, J., Cristina, Soria, A., (2014). Essential Oil Composition of Asteriscus maritimus (L.) Less. from Spain. J Plant Biol Soil Health 1: 4.
25. Quezel, P., Santa, S., (1963). Nouvelle flore de l'Algérie et des régions désertiques méridionales. Vol II. CNRS., Paris.
26. Rahman, A., Shanta, Z.S., Rashid, M.A., Parvin, T., Afrin, S., Khatun, M.K., Sattar, M.A., (2011). In vitro antibacterial properties of essential oil and organic extracts of Premna integrifolia Linn. Arab J Chem 9: 475– 479.
27. Scognamiglio M., D'Abrosca, B., Fiumano, V., Chambery, A., Severino V., Tsafantakis, N., Pacifico, S., Esposito, A., Fiorentino, A., (2012a). Oleanane saponins from Bellis sylvestris Cyr. and evaluation of their phytotoxicity on Aegilops geniculata Roth. Phytochemistry. 84: 125-134.
28. Scognamiglio, M., Buommino, E., Coretti, L., Graziani, V., Russo, R., Caputo, P., Donnarumma, G., Abrosca, B. D., Fiorentino, A (2016). Phytochemical investigation and antimicrobial assessment of Bellis sylvestris leaves. Phytochemistry Letters J 17: 6-13.
29. Telci, I., Toncer, O, G., Sahbaz, N., (2006). Yield, essential oil content and composition of Coriandrum sativum varieties (var. vulgare Alef. and var. microcarpum DC.) grown in two different locations. J Essent Oil Res 18: 189–193.
30. Voitkevich, S.A., (1999). Efirnye masla dlya parfyumerii i aromaterapii (Volatile Oils for Perfume and Aromatherapy). Pishchevaya Promst, Moscow.