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# 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%),  $\alpha$ -Naphthoquinone (4,8%). Whereas in Asteriscus maritimus stems, the major components were  $\gamma$ -Eudesmol (17.4%), 2-Naphthaleneac etaldehyde, 1,4-dihydro- $\alpha$ ,  $\alpha$ -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- $\alpha$ ,  $\alpha$ -dimethyl-1,4-dioxo- (22,1%), Falcarinol (12%),  $\gamma$ -Muurolene (4.6%) and Pentacosane (4.3%).

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

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## 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 (Na2SO4), and then stored in sealed vials at -18 °C, 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  $\mu$  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  $\mu$  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  $\gamma$ -Eudesmol (17.4%), 2-Naphthaleneac etaldehyde, 1,4dihydro-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- $\alpha$ , 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 y-Eudesmol (17.4 %), 2-Naphthaleneac etaldehyde, 1,4-dihydroα, 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*)- $\beta$ -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,  $\beta$ -pinene and germacrene D bicyclogermacrene and myrcene in Italy, but in French, they were  $\gamma$ -terpinene, capillene, 1-phenyl-2,4-pentadiyne and spathulenol. In Portugal, the main components were  $\beta$ -pinene, cadin-4-en-7-ol,  $\gamma$ -terpinene,  $\alpha$ -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,  $\alpha$ -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).

Pic N°	Rt	Compounds	B. svlvstris	A. maritimus	A. campestris
1	18 479	Decanal		0.4	<b>P</b>
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	

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

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	Banzana 1-mathul-3 5-bic[(trimathulsilu])ovul-	0.6	11	0.7
45	24.470	Denzene, 1-metry 5,5-bis[(trimetry isny 1)0xy]-	0.0	0.4	0.7
45	34.478	Phosphorin, 2,4, 6-tris(1,1-dimethylethyl)-		0.4	
46	34.852	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-			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	0.0	0.4	+
85	44.168	Estradiol	0.3		
86	44.388	2,3,6-TrimethyInaphthoquinone	0.6		
87 88	44.549	4-p-rnordon	1.3	0.6	0.5
89	45.011	α-Naphthoquinone	4.8	0.0	0.0

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

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