aurum

JOURNAL OF HEALTH SCIENCES
A. J. Health Sci.

Volume 1 No 2 | March 2019, 87-94

Research Article

Essential oil composition from aerial parts of *Scolymus hispanicus* L.

Hüseyin Servi

Department of Pharmaceutical Botany, Faculty of Pharmacy, Altınbaş University, Istanbul, Turkey

Submitted: December 26, 2018; Accepted: January 20, 2019

Abstract: The volatile oil composition of *Scolymus hispanicus* L. was investigated. Essential oil of aerial parts were obtained through hydro-distillation and determined with GC-MS analyses. Fifteen compounds were determined in the oil (99.3%) of aerial part. The main compounds were heneicosane (19.4 %), hexahydrofarnesly acetone (17.0%) and phytol (17.0%). Saturated *n*-alkane derivatives (35.2%), oxygenated sesquiterpenes (25.6%) and diterpene (17.0%) were dominated in the oil. Also, the antibacterial activity of volatile oil was studied against *Escherichia coli* and *Staphylococcus aureus* bacteria. But the oil did not show activity against the tested microorganisms at 80-10 mg/mL concentrations. Here, it is reported for the first time on the volatile oil composition of *S. hispanicus*.

Keywords: *Scolymus hispanicus; volatile oils; heneicosan; hexahydrofarnesyl acetone; phytol*

Address of Correspondence: *Hüseyin Servi - huseyin.servi@altinbas.edu.tr, ORCID: orcid.org/0000-0002-4683-855X*
Tel: +90(212)7094528, Department of Pharmaceutical Botany, Faculty of Pharmacy, Altınbaş University, 34147, Bakırköy, Istanbul, Turkey

1. Introduction

Scolymus hispanicus L. (Golden thistle) is a member of Asteraceae family. *Scolymus hispanicus* is mainly found in Southern Europe and North Africa. There are three *Scolymus* L. species in Turkey (Davis, 1975). The plant has antisudorific and diuretic properties (Sari and Tutar, 2010). In Turkey, the root of the plant was used for kidney treatments between 1930-1990 years (Baser, 1993; Sari and Tutar, 2010; Sari et al., 2011). The plant also has been cultivated in Spain and Greece. There are a few research on the chemistry of *Scolymus hispanicus*. The methanol extract from aerial parts of *Scolymus hispanicus* was studied for the presence of phenolic compounds. The extract yielded one new flavonoid, six known flavonoids and four known phenolic acids (Sanz et al., 1993). The butanol extract from leaves of *Scolymus hispanicus* had two flavonol glycosides (Rubio et al., 1995). The flower extract of the plant included rosmarinic acid, orientin, quercetin 5-glucoside, and isorhamnetin 3-galactoside (Rubio et al., 1991). Also, nonacosane, α-amyrin, α-amyrin acetate, α-amyrin tetratriacontanoate, oleanolic acid, β-sitosterol, stigmasterol, fructose, galactose, and mannitol were determined from the root bark of the plant (Erciyas and Baysal, 1989). The methanol extract of *Scolymus hispanicus* was investigated for antioxidant properties by different chemical assays. The extract showed strong antioxidant properties (Çetin, 2012). Taraxasteryl acetate was isolated from the ethanolic extract of the root bark of *Scolymus hispanicus*. The ethanolic extract and taraxasteryl acetate showed strong antispasmodic and spasmogenic activities (Kirimer et al., 1997). The aqueous-methanol extract of *Scolymus hispanicus* was studied on streptozotocin (STZ)-induced type 1 Diabetes Mellitus in rats as therapeutic potential. The extract remarkably improved fasting blood glucose level (Ozkol et al., 2013). The aerial part extracts (methanol and water) of *Scolymus hispanicus* were investigated for antiprotozoal and cytotoxic activities. Both extracts did not show any significant activity (Camacho et al., 2003). Fatty acid profiles of *Scolymus hispanicus* from Spain were studied. The main compounds of the plant were α-linolenic acid (30.55%), linoleic acid (26.44%) and palmitic acid (16.0%) (Morales et al., 2012). The total antioxidant capacity of 80% methanol extract of *Scolymus hispanicus* was studied by using CUPRAC, ABTS, FRAP and Folin assays. The extract showed a low total antioxidant capacity (Alpinar et al., 2009). Knowledge, use and ecology of *Scolymus hispanicus* from two localities in Central Spain were investigated. The result indicated that age and time living in the village showed differences in the knowledge and practice level (Polo et al., 2009).

There are no reports on the volatile oil composition of *S. hispanicus* in the literature. Here, it is reported for the first time on the volatile oil composition of *S. hispanicus*.

2. Materials and Methods

2.1. *Plant Materials*

Scolymus hispanicus was collected in İkitelli (Ziyagökalp)-Başakşehir, Istanbul, Turkey at 100 m altitudes on 27 June 2017 by Hüseyin Servi Ph.D. Identification of plant was done by Hüseyin Servi Ph.D. A herbarium specimen was kept in the Herbarium of Department of Pharmaceutical Botany, Faculty of Pharmacy, Marmara University (Herbarium no. MARE 18451).

2.2. *Isolation of the Volatile Oil*

The volatile oil of *Scolymus hispanicus* (400 g) was obtained by Clevenger apparatus (3 h) with hydrodistillation method. *S. hispanicus* aerial parts produced 0.04% (v/w) essential oil yields. The oil was kept with 1 mL *n*-hexane and hold in amber vials under -20°C till analyses day.

2.3. *Gas Chromatography-Mass Spectrometry Analysis*

The GC-MS analysis was employed with an Agilent 5975C Inert XL EI/CI MSD system in EI mode. Essential oil of aerial part was kept in *n*-hexane was injected (1 µL) in splitless mode. The temperatures of the injector and MS transfer line were adjusted at 250˚C. Innowax FSC column (60 m x 0.25 mm, 0.25 µm film thickness) and helium as carrier gas (1 mL/min) were utilized in GC/MS analyses. The temperature of oven was adjusted to 60˚C for 10 min. and increased to 220˚C at a rate of 4˚C/min. The temperature kept stable at 220˚C for 10 min. and then increased to 240˚C at a rate of 1˚C/min. Mass spectra were saved at 70 eV with the mass range *m/z* 35 to 425. The relative percentage quantities of the separated compounds were calculated from integration of the peaks in MS chromatograms. The analysis was realized in triplicate.

2.4. *Identification of Essential Oil Components*

The determination of volatile oil compounds was realized by comparison with their relative retention indices got by a series of *n*-alkanes (C5 to C30) to the literature (Baser et al., 2000; Demirci et al., 2006; Demirci et al., 2013; Dregus and Engel, 2003; Kirimer et al., 2000; Kürkcüoglu et al., 2003) and with mass spectra comparison to the in-house libraries (Wiley W9N11, NIST11).

2.5. Antibacterial Activity

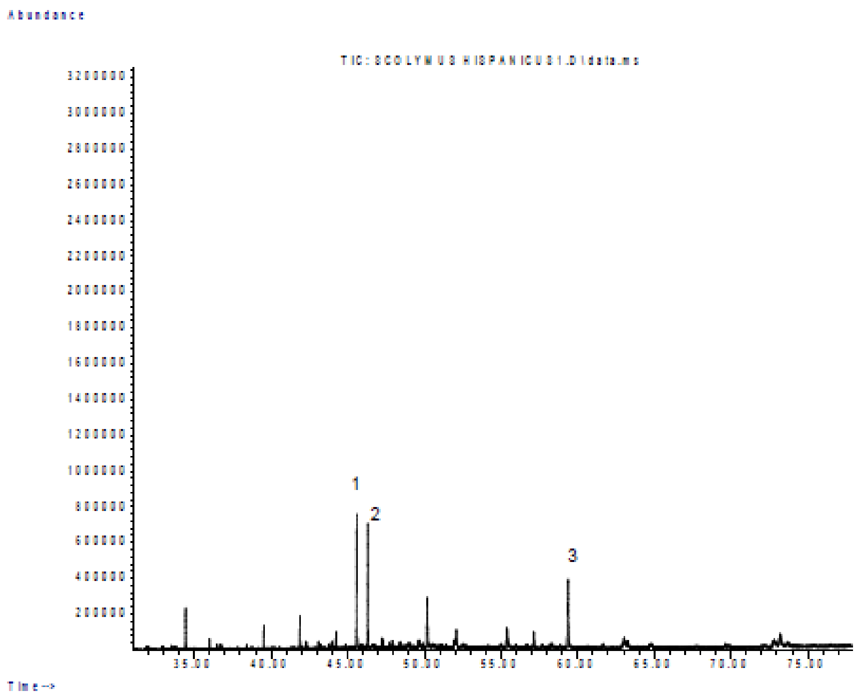
Antibacterial activity of the essential oil was studied against two strains; *Staphylococcus aureus* (ATCC 25923) and *Escherichia coli* (ATCC 25922). Luria-Bertani broth was used as a growth medium for bacteria for the antibacterial tests.

In order to evaluate antibacterial activity, minimum inhibition concentration (MIC_{50}) values were detected by using the broth dilution method. Dimethylsulfoxide (DMSO) was used in the stock solution of volatile oil. The stock solutions were prepared on a 96 well plate as serial dilutions. After incubation at 37°C for 24 h, bacterial suspension concentrations were standardized to McFarland No:0.5. Volatile oil was mixed with bacterial cultures in the range of 1000-1,95 µg/mL as final concentration. It was paid attention to not exceed 1% final concentration for DMSO. After treatment, the bacteria were incubated at 37°C for 24 h. As a negative control, volatile oil-free solutions were utilized. Each test was repeated for three times. Growth analysis was done by using spectrophotometric measurements for MIC determination. Minimum inhibitory concentrations (MIC_{50}) were detected as the minimum concentration at which at least 50% of bacterial growth was missing.

3. Results and Discussion

Scolymus hispanicus aerial parts afforded 0.04% (v/w) amount of essential oils. Fifteen compounds were determined in the oil (99.3%) of aerial part. The main compounds were heneicosane (19.4 %), hexahydrofarnesly acetone (17.0%) and phytol (17.0%). Saturated *n*-alkane derivatives (35.2%), oxygenated sesquiterpenes (25.6%) and diterpene (17.0%) were dominated in the oil. Also, the antibacterial activity of volatile oil was studied against *Escherichia coli* and *Staphylococcus aureus* bacteria. The antibacterial activity of the oil evaluated with MIC values between 80-10 mg/mL. But the oil did not show activity against the tested microorganisms at 80-10 mg/mL concentrations.

Figure 1. GC-MS Chromatogram of *Scolymus hispanicus* essential oil.



1: Heneicosane; **2:** Hexahydro farnesyl acetone; **3:** Phytol.

Table 1. The volatile oil composition of *Scolymus hispanicus*

RRI[1]	RRI Lit.[2]	Compound	I[3] (%)	II (%)	III (%)	Average[4] (%)	SD[5]	Identification method[6]
1680	1687	Estragole	5.6	5.7	5.3	5.5	0.2	RI, MS
1733	1737	β-Bisabolene	1.4	1.4	1.3	1.4	0.1	RI, MS
1861	1864	*Trans*-geranyl acetone	3.6	3.5	3.3	3.5	0.2	RI, MS
1951	1958	*Trans*-β-ionone	4.7	4.6	4.4	4.6	0.2	RI, MS
2044		*Cis*-davanone	2.5	2.3	2.4	2.4	0.1	MS
2100	**2100**	**Heneicosane**	**20.0**	**19.5**	**18.6**	**19.4**	**0.7**	RI, MS, Ac
2131	**2131**	**Hexahydro farnesyl acetone**	**16.4**	**16.6**	**18.1**	**17.0**	**0.9**	RI, MS
2300	2300	Tricosane	7.7	7.6	7.4	7.6	0.2	RI, MS, Ac
2374	2380	α-Hexyl cinnamaldhyde	1.7	1.6	1.5	1.6	0.1	RI, MS
2380	2384	Farnesyl acetone C	3.3	3.3	1.2	2.6	1.2	RI, MS
2501	2500	Pentacosane	5.2	5.2	5.1	5.2	0.1	RI, MS, Ac
2551	2592	Diisobutyl pthalate	3.7	3.6	3.6	3.6	0.1	RI, MS
2614	**2622**	**Phytol**	**17.3**	**17.1**	**16.5**	**17.0**	**0.4**	RI, MS
2701	2700	Heptacosane	2.9	3.1	3.1	3.0	0.1	RI, MS, Ac
2909	2931	Hexadecanoic acid	4.0	5.0	6.2	5.1	1.1	RI, MS
		Oxygenated sesquiterpene	25.8	25.9	25.0	25.6		
		n-alkane derivatives	35.8	35.4	34.2	35.2		
		Diterpene	17.3	17.1	16.5	17.0		
		Fatty acid and esters	4.0	5.0	6.2	5.1		
		Monoterpene	3.6	3.5	3.3	3.5		
		Others	13.5	13.2	12.8	13.2		
		Total	**100.0**	**100.0**	**98.0**	**99.3**	**1.2**	

[1]RRI: Relative retention time; [2]RRI Lit.: Relative retention time in the literature; [3]The analysis results; [4,5]The average % area of analysis with ± standard deviation (SD); [6]Identification method.

According to recent genetic analyses, the genus *Scolymus* is related to with some genus such as *Gundelia*, *Hymenonema*, and *Catananche* (Liveri et al., 2016). Previously, essential oils with high content of thymol (11.2%), γ-terpinene (9.8%), germacrene D (6.6%) and *p*-cymene were reported for *Gundelia tournefortii* from Iran (Dastan and Yousefzadi, 2016). And an another study from Iran, palmitic acid (12.48%), lauric acid (10.59%), α-ionene (6.68%), myristic acid (4.45%), 1-hexadecanol,2-methyl (3.61%), phytol (3.6%), and β-turmerone (3.4%) were major components of volatile oil of *Gundelia tournefortii* (Farhang et al., 2016). Additionally, essential oils of two varieties of *Gundelia tournefortii* from Turkey were studied. The main compounds were determined thymol (24.5%) in *G. tournefortii* var. *tournefortii* oil, germacrene D (21.6%) in *G. tournefortii* var. *armata* oil (Bağcı et al., 2010). The main compounds of *Scolymus hispanicus* were not detected in the oil of *Gundelia tournefortii* from Iran and Turkey (Dastan and Yousefzadi, 2016; Bağcı at al., 2010). But these main compounds were contained low amounts in the oil of *Gundelia tournefortii* from Iran and the results of the essential oil analysis of two species, some similarities observed in their compositions (Farhang et al., 2016).

Conclusion

The volatile oil composition of *S. hispanicus* from Turkey was studied for the first time. There is no research on the volatile oil of *Scolymus* genus, that's why it is hard to give a comment on the chemo-systematic situation of *Scolymus hispanicus* depending on the present study. The results will help further research on the chemistry of *Scolymus* genus.

Conflict of Interests

Author declares no conflict of interests.

References

Alpinar, K., Oezyuerek, M., Kolak, U., Gueclue, K., ARAS, Ç., Altun, M., & APAK, R. (2009). Antioxidant capacities of some food plants wildly grown in Ayvalik of Turkey. Food Science and Technology Research, 15(1), 59-64.

Bagcı, E., Hayta, S., Kılıc, O., & Kocak, A. (2010). Essential oils of two varieties of *Gundelia tournefortii* L. (Asteraceae) from Turkey. Asian Journal of Chemistry, 22(8), 6239-6244.

Baser, K. H. C. (1993). 60 yillik bir Türk bitkisel ilaci Lityazol Cemil (60 year-old Turkish plant made medicine: Lityazol Cemil). TAB Bulletin, 7/8, 13–18.

Başer, K. H. C., Özek, T., Demirci, B., & Duman, H. (2000). Composition of the essential oil of *Glaucosciadium cordifolium* (Boiss.) Burtt et Davis from Turkey. Flavour and Fragrance Journal, 15(1), 45-46.

Camacho, M. D. R., Phillipson, J. D., Croft, S. L., Solis, P. N., Marshall, S. J., & Ghazanfar, S. A. (2003). Screening of plant extracts for antiprotozoal and cytotoxic activities. Journal of Ethnopharmacology, 89(2-3), 185-191.

Çetin, A. (2012). *Scolymus hispanicus* L. (Asteraceae)'un in vitro antioksidan özelliklerinin farklı metotlar ile araştırılması. Yüksek Lisans Tezi, Selçuk University.

Dastan, D., & Yousefzadi, M. (2016). Volatile oil constituent and biological activity of *Gundelia tournefortii* L. from Iran. Journal of Reports in Pharmaceutical Sciences, 5(1), 18-24.

Davis, P. H. (1975). Flora of Turkey and the East Aegean Islands. Vol. 5. Edinburgh: University of Edinburgh Press, 295-311.

Demirci, B., Baser, K. H. C., & Dadandi, M. Y. (2006). Composition of the Essential Oils of *Phlomis rigida* Labill. and *P. samia* L. Journal of Essential Oil Research, 18(3), 328-331.

Demirci, B., Yasdıkcıoglu, G. K., & Baser, K. H. C. (2013). Sesquiterpene hydrocarbons of the essential oil of *Actinolema macrolema* Boiss. Turkish Journal of Chemistry, 37(6), 917-926.

Dregus, M. & Engel, K. H. (2003). Volatile constituents of uncooked rhubarb (*Rheum rhabarbarum* L.) stalks. Journal of Agricultural and Food Chemistry, 51(22), 6530-6536.

Erciyas, E., & Baysal, M. (1989). 8+ α-Amyrin tetratriacontanoate, a new triterpene from *Scolymus hispanicus*. Pharmazie, 44(8).

Farhang, H. R., Vahabi, M. R., & Allafchian, A. R. (2016). Chemical compositions of the essential oil of *Gundelia tournefortii* L.(Asteraceae) from Central Zagros, Iran. Journal of Herbal Drugs (An International Journal on Medicinal Herbs), 6(4), 227-233.

Kirimer, N. E., Tunalier, Z., Başer, K. H. C., & Cingi, I. (1997). Antispasmodic and spasmogenic effects of *Scolymus hispanicus* and taraxasteryl acetate on isolated ileum preparation. Planta medica, 63(06), 556-558.

Kirimer, N., Tabanca, N., Özek, T., Tümen, G. & Baser, K. H. C. (2000). Essential oils of annual *Sideritis* species growing in Turkey. *Pharmaceutical Biology*, 38(2), 106-111.

Kürkçüoğlu, M., Demirci, B., Tabanca, N., Özek, T. & Başer, K. H. C. (2003). The essential oil of *Achillea falcata* L., Flavour and Fragrance Journal, 18(3), 192-194.

Liveri, E., Tomasello, S., Oberprieler, C.H. & Kamari, G. (2016). Cytological and phylogenetic study of the Greek endemic genus *Hymenonema* Cass. (Cichorieae, Compositae). XV. Optima Meeting.

Morales, P., Ferreira, I. C., Carvalho, A. M., Sánchez-Mata, M. D. C., Cámara, M., & Tardío, J. (2012). Fatty acids profiles of some Spanish wild vegetables. Food Science and Technology International, 18(3), 281-290.

Ozkol, H., Tuluce, Y., Dilsiz, N., & Koyuncu, I. (2013). Therapeutic potential of some plant extracts used in Turkish traditional medicine on streptozocin-induced type 1 diabetes mellitus in rats. The Journal of Membrane Biology, 246(1), 47-55.

Polo, S., Tardío, J., Vélez-del-Burgo, A., Molina, M., & Pardo-de-Santayana, M. (2009). Knowledge, use and ecology of golden thistle (*Scolymus hispanicus* L.) in Central Spain. Journal of Ethnobiology and Ethnomedicine, 5(1), 1-13.

Rubio, B., Díaz, A. M., Velazquez, M. P., & Villaescusa, L. (1991). Caffeoyl and flavonoid compounds in *Scolymus hispanicus*. Planta Medica, 57(2), 130.

Rubio, B., Villaescusa, L., Diaz, A. M., Fernandez, L., & Martin, T. (1995). Flavonol glycosides from *Scolymus hispanicus* and *Jasonia glutinosa*. Planta medica, 61(06), 583-583.

Sanz, M. J., Terencio, M. C., Mañez, S., Rios, J. L., & Soriano, C. (1993). A new quercetin-acylglucuronide from *Scolymus hispanicus*. Journal of Natural Products, 56(11), 1995-1998.

Sari, A. O., & Tutar, M. (2010). Effects of Light, Cold Storage, and Temperature on Seed Germination of Golden Thistle (*Scolymus hispanicus* L.). Journal of Herbs, Spices & Medicinal Plants, 15(4), 318-325.

Sari, A. O., Tutar, M., Bilgiç, A., Baser, K. H. C., Özek, G., Koşar, M. (2011). Şevketi Bostan (*Scolymus hispanicus* L.) Bitkisini Kültüre Alma ve Seleksiyon Islahı. Anadolu Ege Tarımsal Araştırma Enstitüsü Dergisi, 21(2), 1-10.