Türk Tarım ve Doğa Bilimleri Dergisi 4(4): 456–460, 2017

TÜRK
TARIM ve DOĞA BİLİMLERİ
DERGİSİ

TURKISH
JOURNAL of AGRICULTURAL
and NATURAL SCIENCES

www.dergipark.gov.tr/turkjans

Evaluation of Essential Oil Composition Genus *Dittrichia* L. (Asteraceae) Plants in Aydın/Turkey

[1]Emre SEVİNDİK*, [2]Mehmet Yavuz PAKSOY

[1]Faculty of Agriculture, Department of Agricultural Biotechnology, Adnan Menderes University, South Campus, Cakmar, Aydin, Turkey
[2]Munzur University, Faculty of Engineering, Department of Enviromental Engineering, Tunceli 62100, Turkey

*Corresponding author: ph.d-emre@hotmail.com

Received: 20.06.2017 Received in Revised: 21.08.2017 Accepted: 08.09.2017

Abstract

The genus *Dittrichia* (Asteraceae), described by Greuter as a small genus, was previously known as a part of Inula and has a widespread Mediterranean distribution, marginally penetrating in the Atlantic European territories and in Middle East. The essential oil chemical compositions were derived from the genus *Dittrichia* L. plants were examined in the present study. The study material, *Dittrichia viscosa* (L). Greuter and *Dittrichia graveolens* (L.) Greuter were collected West Anatolian (Aydın/Turkey) ecological conditions in September-October 2015. Essential oils of the leaves were extracted by Clevenger apparatus. Essential oil compositions were determined with Gas Chromatography-Mass Spectrometry (GC-MS) device. The results from the gas chromatography-mass spectrometry analysis showed that the obtained levo-bornyl acetate from *D. graveolens* was with the highest percentage (25.23%). The 2,4-dioxo-3-methyl-6-isopropyl pyrido[2,3-b]-[1,4]pyrazine in *D. viscosa* was with the highest percentage (29.02%).

Keywords: Essential oil, GC-MS, *Dittrichia*, Aydın/Turkey

Aydın/Türkiye'de Yayılış Gösteren *Dittrichia* L. (Asteraceae) Cinsinin Kimyasal Kompozisyonunun Değerlendirilmesi

Özet

Küçük bir cins olarak Greuter tarafından tanımlanan *Dittrichia* (Asteraceae) cinsi, önceden Inula'nın bir bölümü olarak biliniyordu ve Atlantik Avrupa ülkelerinde, Ortadoğu ve Akdeniz bölgesinde yayılış göstermektedir. Bu çalışma da *Dittrichia* cinsine ait bitkilerden elde edilen uçucu yağların kimyasal bileşimi incelenmiştir. Çalışma materyali *Dittrichia viscosa* (L). Greuter ve *Dittrichia graveolens* (L.) Greuter Eylül-Ekim 2015 tarihinde Batı Anadolu (Aydın/Türkiye) ekolojik koşullarında toplanmıştır. Yaprakların uçucu yağları Clevenger cihazıyla ekstrakte edildi. Esansiyel yağ bileşimleri Gaz Kromatografisi-Kütle Spektrometresi (GC-MS) cihazı ile belirlendi. Gaz kromatografisi-kütle spektrometresi analizinin sonuçları, *D. graveolens* bitkisinden elde edilen uçucu yağda levo-bornyl acetate en yüksek düzeyde (% 25.23) olduğunu gösterdi. *D. viscosa* bitkisinde ise 2,4-diokso-3-metil-6-izopropil pirido [2,3-b]- [1,4] pirazin en yüksek düzeyde (% 29.02) olduğu belirlendi.

Anahtar Kelimeler: Uçucu yağ, GC-MS, *Dittrichia*, Aydın/Turkey

Introduction

The use of aromatic plants has very long history in the World. According to World Health Organization (WHO), approximately 20. 000 plants have been used for medicinal proposes, 4 000 of which have been widely used (Salehi-Arjmand et al., 2014). Recently, there has been great interest in essential oils and extracts of medicinal and edible plants, herbs, and spices for the development of alternative food additives, in order to prevent the growth of food-borne pathogens or to delay the onset of food spoilage (Çetin et al., 2011). Therefore the use of essential oils for treatment of various inflammatory diseases like rheumatism, fever, diabetes suggest that oxidative stress play a role in human disease and intake of antioxidants may improve human health (Burits et al., 2001).

The Asteraceae family, the largest known plant family in the World (Nylinder and Anderberg, 2015), this family consists of approximately 23.000 species in 1535 genera (Öztürk and Çetin, 2013). Asteraceae family contains economically important species. The family contains food plants, raw material resources, medical and medicinal plants, tender and succulent plants, wild weeds and poisonous plants. Acquisition of esculents such as honey and acquisition of cooking oil from this family is used in many fields such as pharmaceutical industry. In addition, many of the species are cultivated as ornamental plants in Asteraceae (Süslü et al., 2010; Paksoy et al., 2016). The genus *Dittrichia,* described by Greuter (Greuter, 1973), as a small genus *Dittrichia* was previously considered as a section of *Inula* (Petropoulou et al., 2004) has a widespread Mediterranean distribution, marginally penetrating in the Atlantic European territories and in Middle East. According to literature data it is well defined and homogeneous in its proposed circumscription, showing close relationships with the genus *Inula* L. (Brullo and Marco, 2000). Genus *Dittrichia* Greuter is represented two species in Turkey. These species *Dittrichia viscosa* [Syn. *Inula viscosa* (L.) Aiton] and *Dittrichia graveolens* [Syn. *Inula graveolens* (L.) Desf.]. *D. viscosa* is well known for a wide variety of antimicrobial activities. The extracts of the plant possessed antiviral and antioxidant properties. Compounds isolated from the extracts exhibited anti-inflammatory and gastric antiulcerous effects (Al-Qudah et al., 2010). In Turkey the fresh aerial parts are used in folk medicine (Turkish name 'kokarot') for the treatment of wounds (Baytop, 1984). *D. graveolens* has been used in Asian and European traditional medicine as anti-infective, anti-inflammatory, anti-pathogenic, and sedative medication to treat UTI, hemorrhoid, wounds, and leishmaniosis (Maxia et al., 2008).

The aim of the present study is to determine the essential oil contents of the genus *Dittrichia* plants grown under West Anatolian ecological conditions. Furthermore, this study provides a scientific basis for future studies and will help to establish the scientific foundations of traditional treatment methods commonly used by humans.

Materials and Methods

Plant Materials

D.viscosa and *D.graveolens* aerial parts of the plants were collected as study materials in August and October 2015, which are their blooming periods, from Aydın/Turkey (Figure. 1). The collected plants were held in a room without sunlight in fabric bag.

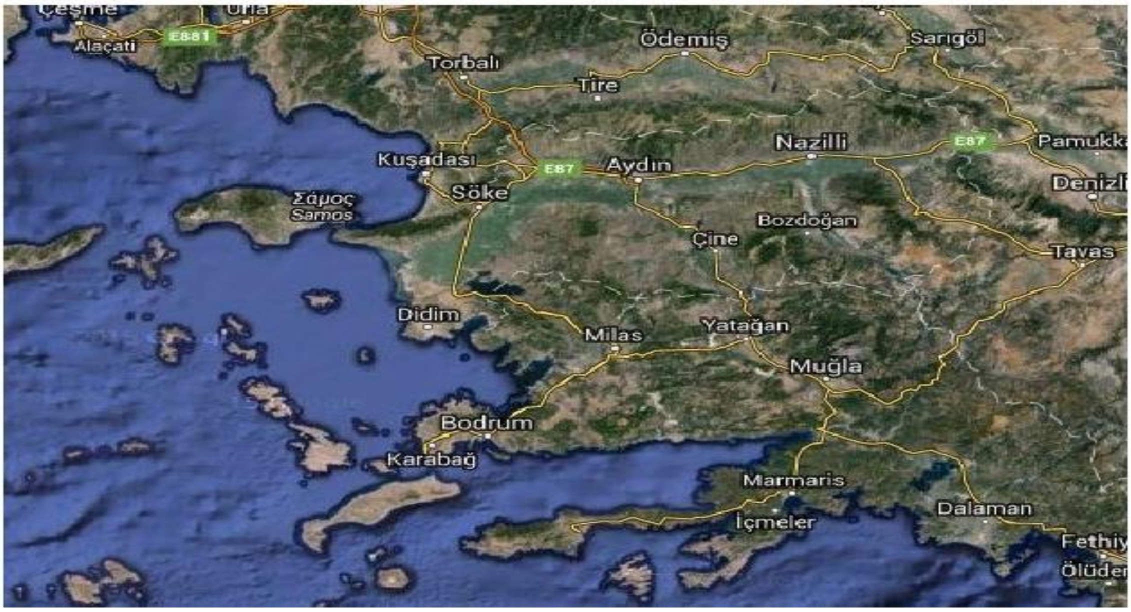

Figure 1: Location of the Aydın region

Isolation of Essential Oils

Approximately, 150-200 g of plant samples were used for the essential oil extraction process. Extraction was performed with Clevenger apparatus (Basaran cam, Turkey and Misung Scientific Co., Korea) using water distillation.

Table 1. Essential oil composition of *D.viscosa* and *D.graveolens* plants.

D.viscosa			***D.graveolens***		
RT	**Component**	**Percent (%)**	**RT**	**Component**	**Percent (%)**
33.39	α- copaene	0.33	11.41	camphene	1.35
35.21	theaspirane	0.35	34.33	levo-bornyl acetate	25.23
41.41	naphthalene	0.55	34.55	exo-methyl-camphenilol	0.33
44.29	endo-3-butyl-exo-4-methyl bicycle [4.3.0]non-1(9)-en-2-one	0.45	35.05	caryophyllene	1.31
45.42	homoadamantane	0.33	38.16	borneol	17.83
49.44	caryophyllene oxide	3.35	40.06	δ-cadinene	0.43
50.12	farnesol	4.78	40.24	α-amorphene	1.27
50.76	α-copaen-11-ol	0.56	40.38	1H, 4H-3a,6a-methanopentalen-1-one, tetrahydro-, (3aS)- (CAS)	0.32
52.39	2-pentadecanone	0.55	43.25	butanoic acid	0.58
53.38	α-longipinene	3.08	46.96	caryophyllene oxide	2.64
53.47	9-aristolen-α-ol	0.33	47.53	nerolidol	0.31
53.69	4,5-dihydro-5-oxo-3-(p-tolyl) isoxazole	0.40	48.45	1-phenyl-1-deutero-2-propen-1-ol	0.78
53.91	selina-6-en-4-ol	2.58	51.63	naphthalene	13.84
54.28	calarene	0.51	52.20	carvacrol	0.64
54.43	naphthalene	0.30	53.09	α-cadinol	0.63
54.93	carvacrol	0.38	53.80	7-epi-amiteol	1.36
55.43	α-eudesmol	0.64	54.78	adamantane	0.83
55.73	β-eudesmol	2.20	54.97	caryophylla-4 (12), 8(13) diene 5 β-ol	3.53
55.90	(+-)-15-hexadecanolide	0.44	55.89	caryophylla-3 8(13)-dien-5.beta.-ol	1.06
56.01	β-costal	0.54	56.98	caryophyllenol-II	0.91
56.21	decanoic acid	0.31	57.73	verbenol	0.35
56.34	7-epi-amiteol	2.52	58.17	1,1'-bicyclopentyl-1,1'-diol	0.31
56.53	1. β,4,4-trimethyl-bicyclo (3.2.0) hept-6-en-2.α-ol	0.38	60.39	pentacosane	0.60
57.50	caryophylla-4(12),8(13) diene 5 β-ol	1.85	61.04	cyclobutane carboxylic acid	1.65
58.46	caryophylla-3 8(13)-dien-5.beta.-ol	0.44	68.61	benzoic acid	0.59
59.55	vulgarol B	0.45	70.54	1-methyl-2-ethyl-3-oxo dihydro isoindole	0.42
61.56	(+-)-3-methyl-1-penten-3-ol	0.36	76.88	palmitic acid	1.09
62.16	pentacosane	0.33	88.99	3-(4-methylphenyl)-5,5-dimethyl-4-phenyl-5h-pyrazole	1.86
65.69	γ-costol	0.39	95.88	benzoxazole	1.85
65.95	β-costol	0.92	96.98	isodrimenin	4.47
67.93	benzoic acid	0.35	102.81	linoleic acid	0.48
79.35	palmitic acid	0.40			
91.88	7-tert-butyl-4-methyl-5-nitro benzisoxazole	4.08			
99.00	2,4-dioxo-3-methyl-6-isopropyl pyrido[2,3-b]-[1,4]pyrazine	29.02			
101.86	eudesma-5,11(13)-dien-8,12-olide	24.49			
Total		**88.94**	**Total**		**88.85**

GC-MS Analysis

Essential oil analysis were conducted at Eskisehir Anadolu University Medicinal Plants, Drugs and Scientific Research Center (AUBİBAM) by HP 6890 Series Gas Chromatograph 5973 Mass Selective Dedector System instrument equippped with an Agilent HP-Innowax colon (60m X 0.25 mm film, 0.25 µm thickness). Hellium (He) was used as a carrier gas. Conditions were as follows; from 50 ºC to 240 ºC by an increase of 4 ºC / minutes. At 240 °C, 40 minutes of waiting time were implemented. Injection port and detector temperature were 250ºC and 280ºC respectively. Characterization of essential oil components was based on the library (Wiley and NIST) comparision with the mass spectra of the injected essential oil samples.

Results and Discussion

Essential oils obtained from plants are important natural products used as raw materials in many fields such as perfumes, cosmetics, aromatherapy, and food industry (Yüce et al., 2016). In our study, totaly 121 components were detected as *D.viscosa* aerial parts essential oil composition. 88.94% of the total essential oils in 35 components (components which are ≥0.3% in total ratio) were given in Table 1. The essential oils obtained from the *D.viscosa* plant were detected to contain 2,4-dioxo-3-methyl-6-isopropyl pyrido[2,3-b]-[1,4] pyrazine (29.02%) at most (Table 1). Previous studies detected the highest amounts obtained from essential oils as follows; borneol (25.2%) (Perez-Alonso et al., 1996), fokienol (20.87%) (Al-Qudah et al., 2010), isocostic acid (56.83%) (Madani et al., 2014), 12-carboxyeudesma-3,11 (13) diene (28.88%) (Haoui et al., 2015) and azulene (9.2%) (Alalan et al., 2015). For *D. graveolens*, 110 component were detected aerial parts essential oil composition. 88.85% of the total essential oils in 31 components (components which are ≥0.3% in total ratio) were given in Table 1. The essential oils obtained from the *D.graveolens* plant were detected to contain levo-bornyl acetate (25.23%) at most (Table 1). Past studies detected the highest amounts obtained from essential oils as follows; epi-α-cadinol (30.2%) (Petropoulou et al., 2004), bornyl acetate (43.1–73.1%) (Blanc et al., 2004), 1.8-cineole (%22.4) (Kılıç, 2014), isobornylacetate (50.8 %) (Boudouda et al., 2013), 1.8 cineole (54.89%) (Angel et al., 2011), borneol (43.6%) (Mitic et al., 2016). When checked the old studies results, their results was different then our results both as substances and proportional. This is could be explained by the fact that essential oil composition may have different quality and quantity under different geographical and environmental conditions, and also during the different periods of the plant growth (Mazandarani et al., 2013).

Conclusion

According to the results obtained in this study, these results can be a valuable resource for future biotechnological, biological diversity, pharmaceutical and medical studies. At the same time, biodiversity and conservation biology will help you understand the importance of efforts.

References

Alalan, L., AL-Shammaa, I., Al-nouri, A.S. 2015. Analysis of the chemical composition of essential oil extracted from Syrian *Inula viscosa* (L). J. Chem. Pharm. Res. 7(12): 861-864.

Al-Qudah, M.A., Al-Jaber, H.I., Mayyas, A.S., Abu-Orabi, S.T., Abu Zarga, M.H. 2010. Chemical Compositions of the Essential Oil from the Jordanian Medicinal Plant *Dittrichia viscosa*. Jordan Journal of Chemistry. 5(4): 343-348.

Angel, N., Mahmoudabadi, A.Z., Darvishi, L. 2011. Volatile constituents and anti-candida activity of the aerial parts essential oil of *Dittrichia graveolens* (L.) Greuter grown in Iran. African Journal of Pharmacy and Pharmacology. 5(6): 772-775.

Baytop, T. 1984. Therapy with Medicinal Plants in Turkey. Sanal Press, Istanbul 167.

Blanc, M.C., Muselli, A., Bradesi, P., Casanova, J. 2004. Chemical composition and variability of the essential oil of *Inula graveolens* from Corsica. Flavour and Fragrance Journal. 19: 314-319.

Boudouda, H.B., Kabouche, A., Aburjai, T., Kabouche, Z. 2013. GC-MS Analysis of *Inula graveolens* (L.) Desf. from Algeria. Journal of Essential Oil Bearing Plants. 16(5): 651-654.

Brullo, S., Marco, G. 2000. Taxonomical Revision of the Genus *Dittrichia* (Asteraceae). Portugaliae Acta Biol. 19: 341-354.

Burits, M., Asres, K., Bucar, F. 2001. The antioxidant activity of the essential oils of *Artemisia afra*, *A. abyssinica* and *Juniperus procera*. Phytother. Res., 15: 103-108.

Çetin, B., Çakmakçı, S., Çakmakçı, R. 2011. The investigation of antimicrobial activity of thyme and oregano essential oils. Turkish Journal of Agriculture and Forestry. 35: 145-154.

Greuter, W. 1973. Exsiccatorum genavensium a conservatorio botanico distrubutorum. Genavae. 4.

Haoui, I.E., Derriche, R., Madani, L., Oukali, Z. 2015. Analysis of the chemical composition of essential oil from Algerian *Inula viscosa* (L.)

Aiton. Arabian Journal of Chemistry. 8: 587-590.

Kılıç, Ö. 2014. Chemical Composition of Two *Inula* sp. (Asteraceae) Species from Turkey. Iğdır Univ. J. Inst. Sci. & Tech. 4(1): 15-19.

Madani, L., Derriche, L., Haoui, I.E. 2014. Essential oil of Algerian *Inula viscosa* leaves. Journal of Essential Oil Bearing Plants. 17(1): 164-168.

Maxia, A., Lancioni, M.C., Balia, A.N., Alborghetti, R., Pieroni, A., Loi, M.C. 2008. Medical ethnobotany of the Tabarkins, a Northern Italian (Ligurian) minority in south-western Sardinia. Genetic Resources and Crop Evolution. 55: 911-24.

Mazandarani, M., Mirdeilami, S.Z., Pessarakli, M. 2013. Essential oil composition and antibacterial activity of *Achillea millefolium* L. from different regions in north east of Iran. J. Med. Pl. Res. 7(16): 1063-1069.

Mitic, V., Jovanovic, V.S., Ilic, M., Jovanovic, O., Djordjevic, A. and Stojanovic, G. 2016. *Dittrichia graveolens* (L.) Greuter Essential Oil: Chemical composition, multivariate analysis,and antimicrobial activity. Chemistry & Biodiversity 13: 85-90.

Nylinder, S., Anderberg, A.A. 2015. Phylogeny of the Inuleae (Asteraceae) with special emphasis on the Inuleae-Plucheinae. Taxon. 64(1): 110-130.

Öztürk, M., Çetin, Ö. 2013. *Inula tuzgoluensis* (Asteraceae), a new species from Central Anatolia, Turkey. Turkish Journal of Botany. 37: 825-835.

Paksoy, MY, Selvi, S, Sevindik, E, Uysal, H. 2016. Soil content in the *Anacyclus* L. (Asteraceae) genus growing in Turkey. Turkish Journal of Life Sciences. 1(1): 8-12.

Perez-Alonso, M.J., Velasco-Negueruela, A., Duru, M.E., Harmandar, M., Vallejo, M.C.G. 1996. Composition of the Volatile Oil from the Aerial Parts of *Inula viscosa* (L.) Aiton. Flavour and Fragrance Journal. 11: 349-351.

Petropoulou, A., Tzakou, O., Verykokidou, E. 2004. Volatile Constituents of *Dittrichia graveolens* (L.) Greuter from Greece. Journal of Essential Oil Research. 16: 400-401.

Salehi-Arjmand, H., Hadian, J., Khadivi-Khub, A., Akramian, M. 2014. Comparative analysis of essential oil compositions in seven populations of Bakhtiarian savory in natural and field conditions. Acta physiologiae plantarum, 36(5): 1107-1114.

Süslü, İ., Pehlivan, S., Ekni, M., Şenel, E. 2010. Türkiye'nin çeşitli ballarına kaynak oluşturan compositae (Asteraceae) familyasında *Inula* türlerinin polen morfolojilerine istatistiksel bir yaklaşım. TUBAV Bilim Dergisi. 3(2): 182-187.

Yüce, E., Paksoy, M.Y., Bağcı, E. 2016. Essential Oil Composition of Two *Grammosciadium* DC Species, *G. platycarpum* (Boiss et Hausskn) Schischk and *G. macrodon* Boiss (Apiaceae), from Turkey. Tropical Journal of Pharmaceutical Research. 15(2): 411-414.