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Essential oil yield and compositions of sage (*Salvia officinalis* L.) cultivated in different province of Turkey

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Abstract

The essential oils from three Salvia species from Konya, Karaman and Elazığ locations were analyzed by gas chromatography – mass spectrometry (GC-MS). In this study, ıt was investigated essential oil yield and compositions of sage (*Salvia officinalis* L.) cultivated in different province Turkey (Elazıg, Karaman, Konya). The air-dried herb parts of sage (*Salvia officinalis* L.) were subjected to hydrodistillation for 3 h using a Clevenger-type apparatus to produce essential oil. The GC-MS analysis was carried out with Agilent 7890 GC-MS system. The relative percentages of the separated compounds were calculated from total ion chromatograms. The identification of the oil components was based on the Wiley and NIST mass spectral library. The sage essential oil was determined as 1.7% in Konya, 1.6% in Karaman and 1.1% in Elazığ, respectively. The essential oil of the sage cultivated in Konya is 1.7% and its major components are α-thujone (15,04%), 1,8 cineole (13,46%) and camphor (8,90%). The essential oil of sage cultivated in Karaman is 1.6 % and the major components are camphor (26.22%), α-thujone (20.02%) and 1.8 cineole (10.54). The essential oil of the sage cultivated in Elazığ is 1,1% and the major constituents are α-thujone (24,55%), 1,8 cineloe (14,42%) and camphor (11,15%). According to the results of this study, it was determined that significant differences between essential oil yield and components of sage (*Salvia officinalis* L.) produced in different provinces of our country.

Keywords: Sage, *Salvia officinals,* Essential oil composition, Location

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Introduction

Salvia officinalis is known as sage or garden sage. Salvia comes from the Latin salveo and salvaro, terms that mean “save” and “cure.” (Anonymus, 2018). Sage is a perennial plant rich in volatile oil belonging to Lamiaceae family. The genus Salvia, belonging to Lamiaceae,are represented by over 900 species worldwide. Anatolia is a major centre for Salvia in Asia, 47 of its 90 species endemic to Turkey (Kan et al, 2007). The sage is a herbaceous or bushy plant that can be grow up to 60-100 cm, and the flowers could differ from the blue to white and it has green leaves with a burning smell. It is fibrous rooted and drought resistant. The branching feature of the plant is quite large. Herbs of sage are used in the pre-flowering period (Felice Senatore et al.,2006). Salvia genus comprises herbaceous, suffructicous or shrubby perennials, rarely biennial or annual, often strongly aromatic plants. Approximately 900 species have been recorded widespread throughout the world. The plant grows mainly in mild and hot climates. Some members of this genus are of economic importance, since they have been used in folk medicine all around the world for their antibacterial, antitumor, antidiabetic antituberculosus, activities and as a flavoring agent in perfumery and cosmetics (Werker et al, 1985; Tzakau et al, 2001). There are some significant activities and properties of Salvia essential oils, including antimicrobial, antioxidant, anticholinesterase, improvement of cognitive performance and mood, reducing work-related stress, antimutagenic, anticancer, antiinflammatory, choleretic activities. The present review reported the main and significant pharmacological activities of salvia essential oils. (Fu et al, 2013).

This study was carried out to determine essential oil yields and volatile oil components in sage herba grown in Konya, Karaman and Elazığ provinces.

Material And Method

Plant Material: Sage seeds used in this study were obtained from Selcuk University Faculty of Agriculture, Department of Medicinal Plants. The Seedlings of *Salvia officinalis* have been cultivated in three different cultivated trials. Samples of *S. officinalis* were harvested from the cultivated trial from Konya, Karaman and Elazığ provinces in Turkey. Plant samples to be used in the analysis of essential oil were harvested in pre-flowering period.

Essential oil yield (%): "Water Distillation Method" was used to obtain the essential oil yield of sage. According to this method, 100 g dry herb samples were subjected to water distillation for 3 hours and a volatile oil was obtained. Volumetric (ml / 100 g) volatile oil yield was determined by Clevenger type essential oil equipment.

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Determination of essential oil components: After the essential oil was obtained, essential oil was identified to the GC-MS to determine its components. The chemical composition of the *S. officinalis* essential oil was performed by GC-MS. The composition of the essential oil was calculated as percentage. The identification of essential oil components was carried out by comparison of the obtained mass spectra with the NIST and Wiley library.

Results and Discussion

The essential oil of the three samples was obtained in yields of 1.1, 1.4 and 1.7% (w/w), based on the dry weight of the plant from cultivated trials in Elazığ, Karaman and Konya respectively. The qualitative and quantitative composition of the oils is presented in Table 1, Figure 1,2,3,4. 12 compounds were identified accounting for 84.88-92.50 %. The 12 components commonly identified in all three province are camphor, α-thujone, 1,8-cineole, viridiflorol, borneol, camphene, limonene, salvene, α-pinene, β-pinene, β-thujone and γ-terpinene It was determined a significant difference in composition between with variations in the amounts of the main compounds: the highest amount of essential oil of 1.8 cineole was obtained from Elazığ province (14.420 %) while the lowest amount was obtained from Karaman province (10.540). In these samples, thujones, characteristic compounds of sage oils, are present in very high amounts (α-thujone 15.040 – 24.552 % and β-thujone 4.716-8.483 %). The highest amount of α-thujone was 24.552 % from Elazığ province, the lowest amount of α-thujone was 20.023 % from Karaman. β-thujone was determined the highest amount with 8.483 % from Elazığ, the lowest amount with 4.716 % from Konya. The amount of β-thujone was determined to 5.192 % from Karaman province.

The other studies reported that *Salvia officinalis* contains 1-2.5% yield of essential oil. It is desired that the yield of essential oil to *Salvia officinalis* is at least 1.5% according to European Pharmacopoeia. The major active compositions of sage essential oil contain R-and β-tocopherol, camphor, cineole, borneol, as well as R-humulene from sesquiterpenes and β-chiophyllene in larger quantities (Mathe et al, 2007). In the other study conducted under the conditions of Çukurova Region Drog was investigated according to different planting times of medicinal sage (*Salvia officinalis* L) and the effects of this plant on the essential oil yield and essential oil components were investigated. Essential oil yield was determined as 1.73-4.80% ,the main components of essential oil are determined as follows: Camphor (16.69%), cineole (12.67%) and thujone (10.69%) (Kırıcı et al, 1996). In a Tunisian study, the main essential oil components were identified as: Camphor (25.14%), α-thujone (18.83%), 1,8-cineole (14.14%), viridiflorol (7.98%), β-thujone (4.46%) and β-caryophyllene (3.30%) (Khedler et al, 2017). The essential oil components were alpha-pinene, beta-pinene, 1,8 cineole, alpha-thujone, beta-thujone, camphor, borneol, alpha-humulene, viridiflorol, and manool account at least 81% of weight in essential oil samples. (Santos-Gomes et al, 2001). It is also seen in our work that the main components are the same as other studies and they are parallel to the quantities.

Conclusion

Results of this study showed monoterpenes 1,8-cineole, camphor and α-thujone are the major constituents of *Salvia officinalis* essential oil. The essential oil composition of *S. officinalis* is highly influenced by genetic and environmental factors, plant parts age, climate conditions, and seasonality (Farhat et al, 2009). The results showed that the sage cultivated from Konya province can be prefered with regard to 1.8 cineloe. It can be used as a high quality raw material for the production of phytopreparations.

Table 1. Common Essential Oil Compounds from Three Locations

RI*	Compounds	% Percentage according to locations		
		Konya	Karaman	Elazığ
1585	Camphor	8,901	26,216	11,151
1425	α-thujone	15,040	20,023	24,552
1250	1,8-cineole	13,460	10,543	14,420
1794	Viridiflorol	9,440	3,816	4,534
1030	α-pinene	4,208	3,786	5,717
1118	β-pinene	6,866	2,839	3,032
1442	β-thujone	4,716	5,192	8,483
1665	Borneol	8,440	1,429	4,291
1073	Camphene	2,708	4,818	3,014
1229	Limonene	1,715	2,076	1,678
1238	γ-terpinene	0,422	0,308	0,392
930	Salvene	0,155	0,130	0,255
1590	Caryophyllene	5,919	1,710	-
1695	β-selinene	5,547	-	3,360
2051	Manool	5,015	4,612	-
TOTAL		92,55	87,50	84,88

RI: Retention indices relative to C8 to C24 *n*-alkanes.

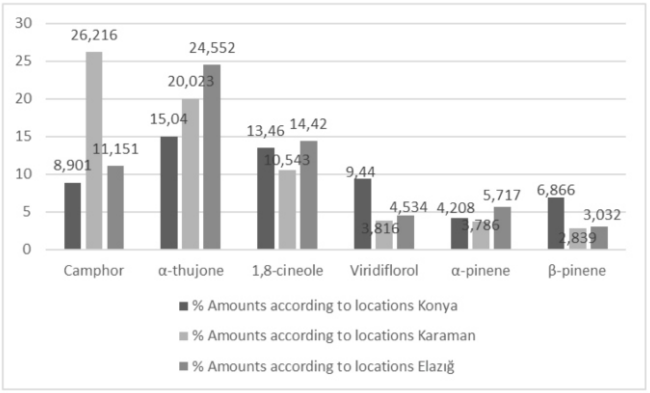

Figure 1. Common Essential Oil Components from Three Location

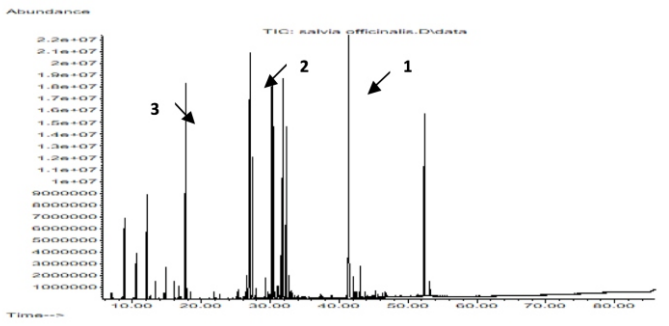

Figure 2. Essential oil composition choromatogram in Konya province 1. α-thujone, 2. 1.8-cineole, 3. camphor

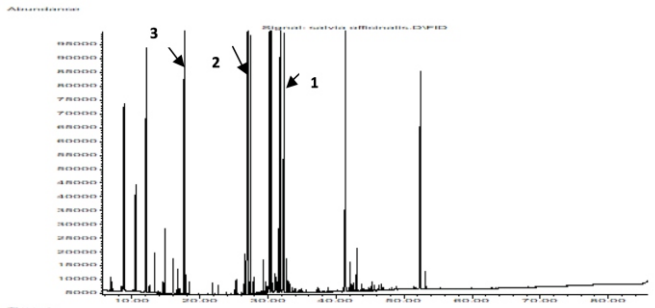

Figure 3. Essential oil composition choromatogram in Karaman province 1.Camphor, 2.α-thujone, 3.1.8-thujone

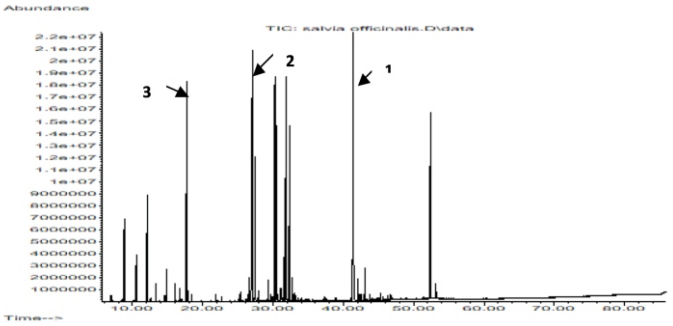

Figure 4. Essential oil composition choromatogram in Elazığ province. 1. α-thujone, 2. 1.8-cineole, 3. Camphor

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