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Morphogenetic Variation for Essential Oils in *Salvia palaestina* Bentham Leaves and Bracts from Turkey

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Abstract: Essential oils from leaves and flowers of *Salvia palaestina* collecting from a wild population of K. Maras provinces in Turkey were obtained by hydrodistillation. The chemical composition of the essential oils was determined by GC/MS and morphogenetical differences in the oil composition of the plant leaves and bracts were obtained. The main constituents of the essential oils were obtained as β-caryophyllene (31.6%) and Germacrene-D (20.9%) in leaves and Linalool (40.21%) and Linalyl acetate (31.3%) in bracts. The result showed that the oil exhibited different oil composition according to plant parts.

Key words: Essential oils, *Salvia palaestina,* morphogenetic variation, Turkey

INTRODUCTION

Turkey is situated at the junction of three important phyto-geographic regions, namely Mediterranean, Irano-Turanian and Euro-Siberian (Baser, 2002). Turkey is an important gene centre for the *Labiatae* family. The family include in Turkey 546 species and 730 taxa. The rate of endemism in the family is 44.2% (Baoer, 1993). *Salvia*, *Sideritis*, *Thymus*, *Satureja*, *Origanum*, *Micromeria*, *Basil*, *Rosmarinus* etc. are widely used in folk medicine and herbal tea in Turkey (Tumen *et al*., 1998). The genus *Salvia* is represented in Turkey by 93 taxa, 45 of which are endemic and the ratio of endemism in the genus 51%. Some members of this genus are of economic importance since they have been used as flavouring agents in perfumery and cosmetics. Sage (*S. officinalis*) has been credited with a long list of medicinal uses: e.g., spasmolytic, antiseptic, astringent (Tzakou *et al*., 2003). Several useful secondary metabolites, belonging to various chemical groups, have been isolated from plants belonging to *Salvia*.

Salvia palaestina Bentham. grows wild in Turkey, Palaestine, Egypt, N. Iraq and Iran. The plant is perennial herb. Stems many, erect, quandrangular, 30-60 cm, branched above, hirsute with long flattened eglandular hairs below, glandular above. Leaves simple, inflorescence paniculate; verticillasters 3-6 flowered, cleary distant. Bracts broadly ovate, often tinged pink or purple. Corolla lilac or whitish-lilac. Wild plants are found on the limestone and igneous slopes cliffs, in quercus scrub, vineyards, 300-1200 m (Davis, 1982).

A few studies have been carried out on the *S. palaestina* species, including flavonoids and terpenoids composition (Hussein *et al*., 1997; Miski *et al*., 1983; Ulubelen *et al*., 1985; Baser, 2002; Senatore *et al*., 2003; Masoudi and Rustaiyan, 2004). Cultivation of medicinal plants for different purpose may face certain limitations such as climate, season, water availability, diseases and pests and scarcity of naturally growing plants (Arikat *et al*., 2004). Therefore aim of this research was to evaluate the results on a study of relationship between plant's morphogenetic variability and essential oil composition of wild *S. palaestina*.

MATERIALS AND METHODS

Plant material: *S. palaestina* collected in middle of July 1999 in K. Maraş provinces (altitude 500 m). Voucher specimens are kept at the herbarium of the Faculty of Science, University of KSU in K. Maras, Turkey.

Isolation of the essential oils: The air dried leaves and bracts were hydrodistilled for 3 h using a Clevenger type apparatus according to the standard procedure described in the European Pharmacopoeie (1975).

Chemical analysis of the essential oils: The GC/MS analyses were carried out at Newe Ya'ar Research Center, Department of Aromatic, Medicinal and Spice Crops in Israel using G 1800 B GCD system with an electron ionization detector (Hewlett-Packard Co, Polo All, CA) for high-resolution gas chromatography-mass spectrometry (GC-MS) analysis. Essential oils were

injected into HP-5 fused silica capillary column (30 m×0.25 mm) was used with helium as the carrier gas (1 mL min^{-1}). The temperature programme was 80°C for 2 min and 80-200°C at 4°C/min. MS were taken at 70 eV. The scanning range was 45-450 m z^{-1}.

RESULTS AND DISCUSSION

The yield of the oil in dry leaves and bracts of *S. palaestina* were obtained and, respectively 0.13 and 0.2%. The stem has no remarkable oil content. From the view point of the oil production the leaf and inflorescence are the valuable organs. The results about essential oil ration of *S. palaestina* were found lower than Baser (2002) reporting that 0.3% oil content.

The oil composition of leaf and bracts of *S. palaestina* were compared with GC/MS and showed great differences due to the plant parts. In *S. palaestina* leaves and bracts sixteen components were identified. Although main components in the leaves were β-caryophyllene (31.6%), germacrene-D (20.9%), bisyclogermacrene (10%) and spatuleneol (9.5%), In the bracts main components were linalool (40.21%), linalyl acetate (31.3%), β-caryophyllene (9.2%) (Table 1).

Table 1: Percentage composition of the essential oils of leaves and bracts from *Salvia Palaestina*

Compound	Leaf (%)	Bract (%)
Limonene	-	0.2
Myrecene	-	1.2
1,8 cineol	-	1.0
Trans-β-ocimene	-	1.3
Isoamyl-2-methyl butyrate	-	0.5
Linalool	2.1	40.2
Nonanal	0.2	-
α-terpineol	0.4	4.5
Linalyl acetate	2.8	31.3
Neryl acetate	-	1.5
Geranyl acetate	-	2.6
Bicycloelemene	4.0	-
α-copaene	4.5	-
β-bourbonene	0.6	-
β-cubebene	1.3	-
β-elemene	1.5	-
β-caryophyllene	31.6	9.2
Aromadendrene	0.9	-
α-bergamotene	-	0.5
α-humulene	2.0	0.5
Germacrene-D	20.9	1.3
Bisyclogermacrene	10.8	0.3
Caryohyllene –oxide	-	2.0
Delta-cadinene	1.3	-
Spatulenol	9.5	-
Total	94.4	98.10

Components are listed according to their elution on silica capillary column

According to our survey of the available literature on the composition of *S.* palaestina, our data agrees with previous study; Masoudi and Rustaiyan (2004) report that aerial parts of *S. palaestina* oil had sixteen oil components and β-caryophyllene and germacrene-D were main components. Also Baser (2002) report that *S. palaestina* oil has linalool and linalyl acetate as main components. The very interesting that our study result also included these four main component but two of them in leaves (β-caryophyllene and germacrene-D) and the other two components (linalool and linalyl acetate) were main component in the flowers. These differences may due to different collecting time and geographical area or because of different vegetation period.

Many plant species from natural populations are known to demonstrate considerable variability of essential oil composition in the leaves and the flower of the plant. Mathe *et al.* (1992) reported that the oil content of *Salvia officinalis* shows great differences in plant parts due to the time of harvest. The maximum content in the leaf occurs in August, while that in the generative organs in June.

Also Gupta *et al.* (2002) reported that Artemisinin content in the *Artemisia absinthium* plant organs was highest in the leaves in the pre flowering stage.

According to Fair groups report (Anonymous, 2000), chemical composition of *Salvia fruticosa* and *S. sclerea* effects at different development stages. Different oil components accumulate at different plant parts during vegetation period. Cecarini *et al.* (2004) report that there was significant differences essential oil composition of *Helianthus annus* leaves and heads.

This results were support by Nacar (1997) reporting that essential oil composition of basil (*Ocimum basilicum*) cultivars differentiated in terms of morphological characters.

As a result, we have demonstrated that there exists a morphogenetical variation in the composition of *S. palaestina* oil. This variation is evident especially with components such as caryophyllene, germacrene-D whose content was highest in the leaves extract and linalool and linaly acetate was highest in flower extract. As a conclusion *S. palaestina* should be harvested at flowering parts or leaves for the purpose of extraction of active constituents.

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