DETERMINATION OF THE ESSENTIAL OIL COMPONENTS OF *Stachys annua* subsp. *annua* var. *annua* PLANT

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ABSTRACT

The genus *Stachys* is one of the largest genera of the Lamiaceae family, and contains about 300 species worldwide and represented by 72 species in the flora of Turkey. Also, *Stachys annua* subsp. *annu*a var. *annua* is widely used in Turkey and among the local people the species known as "dağ çayı". Herbal tea prepared by the method of infusion with the leaves of this plant is used in traditional medicine for colds and diabetes. In addition, it has been used as an antipyretic in Anatolia for many years. The rich essential oil components contained within the plant add a pleasant smell to herbal teas and diterpenoids are an important component of essential oil. In this study, the volatile components of the *Stachys annua* subsp. annua var. annua plants were investigated which collected from the Anzer (1533 m) and Cimil (1750 m) plateau of Rize at the time of flowering. The proportion of essential oils of the plant harvested during the full flowering period and the aromatic components in the essential oil of the plant were determined using the SPME (Solid Phase Microextraction) method in a Gas Chromatography (GC-MS) device. Almost 30 different components were found as a result of the analysis. The main components were found as germacrene-D (18.82%) and camphor (13.82%) in Anzer plateau and germacrene-D (25.2%) and camphor (13.82%) in Cimil plateau.

Keywords: *Stachys annua,* Aromatic Compounds, GC-MS

INTRODUCTION

Stachys L. is a large genus of about 300 species of shrubs and herbs in the Lamiaceae family that grows in temperate and tropical regions of the world except for Australasia and New Zealand (Akçiçek et al., 2012). The majority of investigated taxa in the genus *Stachys* L. are distributed in the Irano-Turanian and Mediterranean phytogeographical regions (Bhattacherjee, 1993). Turkey is one of the richest countries in terms of *Stachys* species diversity, including 91 species (115 taxa) with a 48 percent endemism rate belonging to 15 sections and 2 subgenera (Güner et. al., 2012). Moreover, *Stachys annua* subsp. *annu*a var. *annua* is widely used in Turkey and among the local people the species known as "dağ çayı". Herbal tea prepared by the method of infusion with the leaves of this plant is used in traditional medicine for colds and diabetes (Arituluk and Ezer, 2012). In addition, it has been used as an antipyretic in Anatolia for many years. The rich essential oil components contained

within the plant add a pleasant smell to herbal teas and diterpenoids are an important component of essential oil (Altundag and Ozturk, 2011; Kocak et al. 2017). There are several studies on essential oil composition of *Stachys* species. Venditti et al. (2015) reported that the most abundant compounds were phytol (9.8%), germacrene-D (9.2%), and spathulenol (8.5%) in *Stachys annua* (L.) L. subsp. *annua*. A study conducted by Jahantab et al. (2021) revealed that main essential oil components of *Stachys pilifera* Benth were cis-chrysanthenyl acetate (19.1-48.2%), viridiflorol (1.4-19.1%), trans-caryophyllene (2.3-11.9%), caryophyllene oxide (1.9-11.0%), limonene (2.0- 5.9%) and spathulenol (0.0- 9.5). Javidnia et al. (2003) reported that the main essential oil components of *Stachys lavandulifolia* Vahl were germacrene-D (13.2%), β-phellandrene (12.7%), β-pinene (10.2%). In this study, the volatile components of the *Stachys annua* subsp. annua var. annua plants were investigated which collected from the Anzer (1533 m) and Cimil (1750 m) plateau of Rize at the time of flowering.

MATERIAL AND METHOD

This experiment was conducted at Faculty of Agriculture, Recep Tayyip Erdoğan University in 2021. The plant materials collected from Anzer (1533 m) and Cimil (1750 m) plateau in Rize/Turkey (Figure 1.). The aerial parts of *Calamintha nepeta* (L.) savi. subsp. *glandulosa* collected at the flowering time were used as plant material. The plants were cut at a height of 10-15 cm above the soil level and the flower parts were separated.

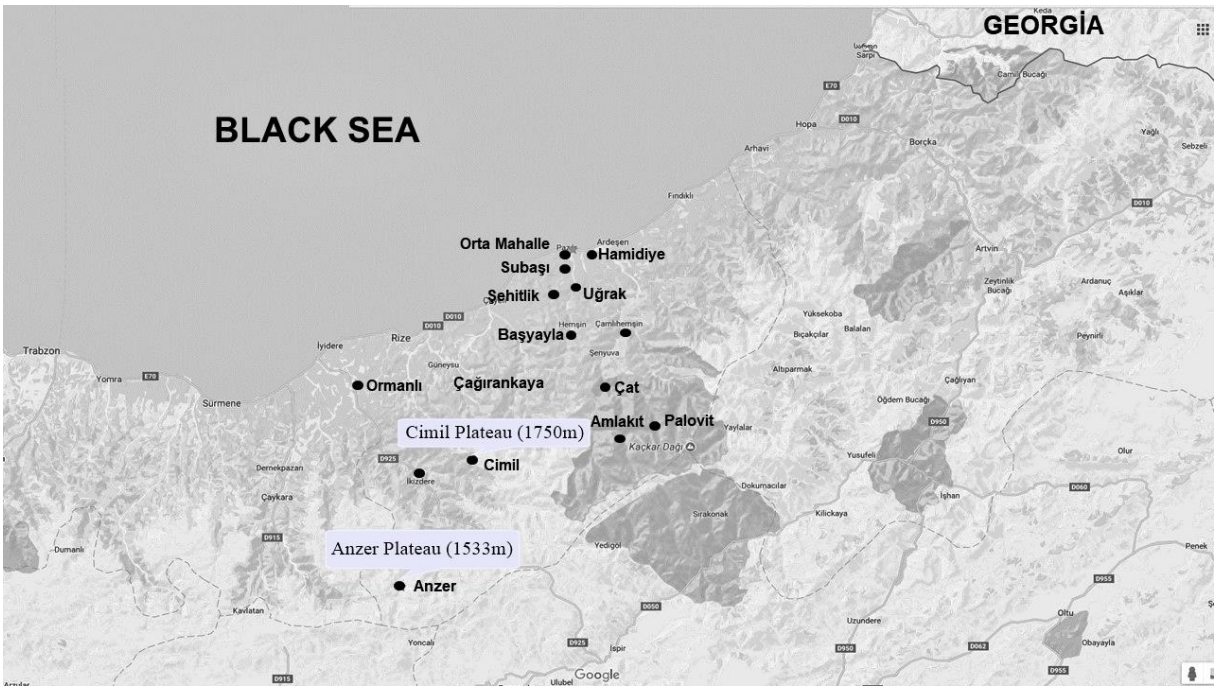

Figure 1. Collection sites of *Stachys annua* subsp. *annua* var. *annua* plants

Dried plant samples weighed 100 g and distilled with Neo-Clevenger apparatus. The essential oil content in herb was calculated as the volume of essential oil in 100 grams of dry sample (ml/100g). In order to determine essential oil components, Shimadzu model GC-MS (2010 Plus) present in RTEU Faculty of Agriculture, Plant Analysis Laboratory was used. SPME (Solid Phase Microextraction) method was used to determine essential oil components. Analysis results were evaluated and reported using related library (Seyis et al., 2021).

RESULTS AND DISCUSSION

Almost 30 different essential oil components of *Stachys annua* subsp. *annua* var. *annua* were found as a result of the analysis. The main essential oil components of the samples collected from Anzer (1533 m) plateau were germacrene-D (18.82%) and camphor (13.82%) and others found as caryophyllene oxide (8.3%), linalool (7.94%), α-himachalene (6.75%), β-bourbonene (6.59%) (Figure 2.). The main essential oil components of the samples collected from Cimil (1750 m) plateau were germacrene-D (25.2%) and camphor (10.4%) and others found as β-bourbonene (9.8%), linalool (9.8%), caryophyllene oxide (7.8%), α-himachalene (7.8%) (Figure 2.).

In the literature, phytol (9.8%), germacrene D (9.2%), and spathulenol (8.5%) was found as the major compounds of the essential oil of flowering aerial parts of *Stachys annua* L. subsp. *annua* (Zellner et al., 2008).

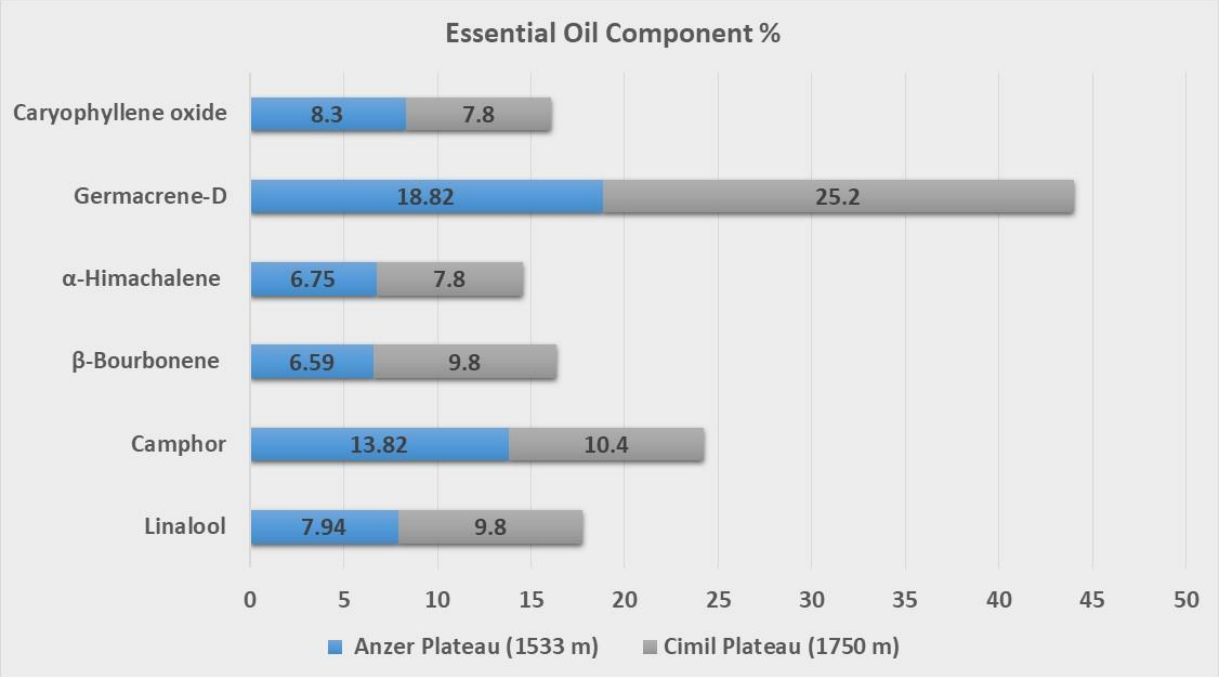

Figure 2. Essential oil components of *S. annua* subsp. *annua* var. *annua* collected from Rize Province

Venditti et al. (2015) reported also that the most abundant compounds were phytol (9.8%), germacrene-D (9.2%), and spathulenol (8.5%) in *Stachys annua* (L.) L. subsp. *annua*. In our study, a different essential oil composition was determined in *Stachys annua* (L.) L. subsp. *annua* collected from Rize plateaus.

The current results revealed that volatile organic compounds of this *Stachys* species grown in Rize contains relatively different components when compared with the results of the same species grown in different places of the world. Chemical differentiation within the same species can occur generally as a result of the varied ecological or geographic origin as well as the genetic differentiation, collection time, climate or method of analysis (Renda et al., 2007).

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