



Glandular Trichome Micromorphology of Medicinal Plant *Teucrium orientale* L. var. *orientale* (Lamiaceae)

İlkay Öztürk Çalı^{*1}, Arzu Cansaran²

¹ Department of Biology, Faculty of Art and Science, Amasya University, Amasya, Turkey

² Department of Mathematics and Science Education, Faculty of Education, Amasya University, Amasya, Turkey

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ABSTRACT: In the paper, glandular trichome micromorphology of *Teucrium orientale* L. var. *orientale* was studied to provide more information for systematic works. *T. orientale* var. *orientale* is a medicinal plant. It is named “Kirveotu” in Turkey. Stem, leaf, calyx and corolla samples of *T. orientale* var. *orientale* were fixed in 70% ethyl alcohol to determine glandular trichomes types and glandular trichome distribution. *T. orientale* var. *orientale* had peltate (Type I) and capitate glandular trichomes (Type II). Peltate ones composed four head cells and were observed both vegetative and reproductive organs. Three types of capitate glandular ones had determined in the study. These were subtype IIA, subtype IIB and subtype IIC capitate glandular trichomes. Subtype IIA and subtype IIB were seen on both vegetative and reproductive organs, whereas subtype IIC was observed on only reproductive ones.

Keywords: Glandular trichome, medicinal plant, micromorphology, *Teucrium orientale* var. *orientale*

INTRODUCTION

Teucrium L. genus belongs to Lamiaceae family. It is a big and composite genus. The main distribution of the genus is Europe, North Africa and Asia (Kastner, 1989; Abu-Assab and Cantino, 1993). The major distribution of *Teucrium* L. is Mediterranean region (Cantino, 1992; Navarro and El Oualidi, 2000).

Teucrium orientale L. var. *orientale* is named “Kirveotu” in Turkey. *T. orientale* var. *orientale* spreads in dry area in Turkey. It is a perennial herbaceous plant. Flowering period of the species is between June and September. This plant is generally distributed in oak, pinus forests and rocky slopes (Emin et al., 2018). Some species of *Teucrium* genus are used in folk medicine in Anatolia because of having different pharmacological effects like antipyretic, antimicrobial, anti-inflammatory, anti-ulcerative, antitumor (Bağcı et al., 2010). In Turkey, *T. orientale* var. *orientale* is used as a spice to put into meals and its flower is used to make tea (Korkmaz and Alpaslan, 2014). *T. orientale* var. *orientale* has strong antioxidant components (Çakır et al., 2006). In addition to this, it was stated that the hemorrhoid patients using the extract of *T. orientale* var. *orientale* plant were healed partly or completely (Emin et al., 2018).

Trichomes are important structures for using in plant taxonomy. Therefore, these features are generally used in lots of studies. Besides, in many studies the importance of the trichomes were stated (Navarro and El Oualidi, 2000; Kaya et al., 2012; Khalik and Hassan, 2012; Osman, 2012; Ecevit-Genç et al., 2017; Zareh et al., 2017). Particularly, trichome micromorphology is often used for taxonomy in all level of Lamiaceae (Marin et al., 1994; Navarro and El Oualidi, 2000; Moon et al., 2009; Ecevit-Genç et al., 2017). Trichomes are widely observed on different organs of plants belong to Lamiaceae family and they are divided into two parts as nonglandular and glandular trichomes. Trichome micromorphology are also used as taxonomic characters in *Teucrium* genus. Especially, these structures are important for infrageneric classification for the genus. Because of this, many studies were mentioned trichomes of *Teucrium* species (Navarro and El Oualidi, 2000; Grubesić et al., 2007; Ecevit et al., 2017).

In the present paper, it is aim to examine the glandular trichome micromorphology of *T. orientale* var. *orientale* to provide more information for future systematic works.

MATERIALS AND METHOD

The plant material was *T. orientale* L. var. *orientale* in the study. The plant was obtained in Çitli village of Gümüşhacıköy in Amasya, Turkey (1150 m, Cansaran 4162) on 20.06. 2016. Their systematic descriptions were carried out according to Davis (1982). Plant samples of the plant was fixed in 70% ethyl alcohol to determine the trichome micromorphology. 30 fresh specimens were used in the study. The sections of plant samples were performed by hand using commercial razor blades. Sartur reagent was used for dying (Çelebioğlu and Baytop, 1949). Trichome preparations were photographed with a Leica ICC50 HD binocular light microscope. The glandular trichome types and distributions were described. These types studied in the paper were classified following the procedure of Metcalfe and Chalk (1972). To investigate the glandular trichomes of the plant,

*Corresponding author : ilkaycali@hotmail.com

surfaces of stem, leaves, calyx and corolla were also photographed with SEM (SEM 515, Philips, The Netherlands). The specimens were prepared according to Robinson et al. (1987).

RESULTS AND DISCUSSION

The study is showed necessary information on glandular trichomes of *T. orientale* var. *orientale*. The paper is the first data on glandular trichome micromorphology of *T. orientale* var. *orientale*.

Glandular trichomes are common feature to Lamiacea species (Werker, 1993). It was stated that trichomes had significant structures in Lamiaceae (Metcalf and Chalk, 1972; Azizian and Culter, 1982). These trichomes especially glandular ones are used in plant taxonomy. Capitate glandular trichomes are frequently seen in Lamiaceae.

T. orientale var. *orientale* had both peltate (Type I) and capitate glandular (Type II) trichomes on stem, leaf, calyx and corolla. The peltate ones consist of a basal epidermal cell, a short stalk and round multicellular secretory head. The secretory head has different number of cells (four, five, six, seven or eight) in the single shield. In the study, it was seen four numbers of cells in the single shield (Table 1, Figure 1 a, b). Peltate trichomes were also observed the surfaces of the stem, leaf, calyx and corolla (Table 1 and Table 2). Besides, these kind of trichomes (Type I) were frequently observed on both vegetative and reproductive organs of the plant (Table 2). Glandular trichomes are very important features because they are used for taxonomic purposes in Lamiaceae (Ascensao et al., 1995). In the paper, *T. orientale* var. *orientale* had four-celled head in a single shield which was agreement with another study (Kamatou, 2006). Serrato-Valenti et al. (1997) said that peltate trichomes were observed frequently on vegetative organs of some species in Lamiaceae, but they were seen rarely on the reproductive organs. In contrast, *T. orientale* var. *orientale* had these kind of trichomes abundantly on all organs of the plant.

In the present study, three subtypes of capitate glandular ones were determined: These were subtype IIA, subtype IIB and subtype IIC. Subtype IIA: A globose unicellular or bicellular head and a stalk of one to two cells (Figure 2 a and Figure 3 a, c, d, e). Subtype IIB: A cup-shape unicellular head and one to two-celled stalk (Figure 2 b, c, d, e, f, g, h, j and Figure 3 f). Subtype IIC: A hemispherical unicellular head and a unicellular or bicellular stalk (Figure 3 b). In the present study, subtype IIA had one or two stalk cells, one base cell and one or two head cells on stem, leaf, calyx and corolla of *T. orientale* var. *orientale*, whereas subtype IIB had two stalk cells, one base cell and one head cell on leaf, calyx and corolla (Table 1). On the other hand, subtype IIC had two stalk cells, one base cell and one head cell on calyx surface of the plant (Table 1). These subtypes were observed in other Lamiaceae family (Serrato-Valenti et al., 1997).

When it comes to glandular trichome distribution on several organ of the plant, *T. orientale* var. *orientale* had subtype IIA and subtype IIB trichomes on both vegetative and reproductive organs while subtype IIC was only seen reproductive organ (Table 2). On the other hand, subtype IIC capitate trichomes were rarely seen on calyx, whereas subtype IIA and subtypes IIB were often observed on stem, leaf, calyx and corolla. Capitate glandular trichomes were important systematic structures and had significant function for pollination in Lamiaceae (Navarro and Oualidi, 2000). Therefore, the presence of capitate glandular ones particularly on calyx and corolla of *T. orientale* var. *orientale* is a significant finding in the study. Werker et al. (1985) also reported these trichomes on calyx and corolla of species in Lamiaceae family.

Table 1. Glandular trichome types on vegetative and reproductive organs of *T. orientale* var. *orientale*

Plant organ	Capitate type (Type II)									Peltate type (Type I)	
	Type IIA			Type IIB			Type IIC			Number of head cell	
	Head cell	Stalk cell	Base cell	Head cell	Stalk cell	Base cell	Head cell	Stalk cell	Base cell		
Stem	2	1	1	-	-	-	-	-	-	4	
	1	1	1	-	-	-	-	-	-	-	
Leaf	2	1	1	1	2	1	-	-	-	4	
	1	1	1	-	-	-	-	-	-	-	
Calyx	1	2	1	1	2	1	1	2	1	4	
Corolla	1	2	1	1	2	1	-	-	-	4	
	1	1	1	-	-	-	-	-	-	-	

Table 2. Glandular trichome distribution on vegetative and reproductive organs of *T. orientale* var. *orientale*

Plant organ	Capitate type (Type II)			Peltate type (Type I)
	Type IIA	Type IIB	Type IIC	
Stem	++	-	-	++
Leaf	+++	++	-	+++
Calyx	+++	+++	+	+++
Corolla	+++	+++	-	+++

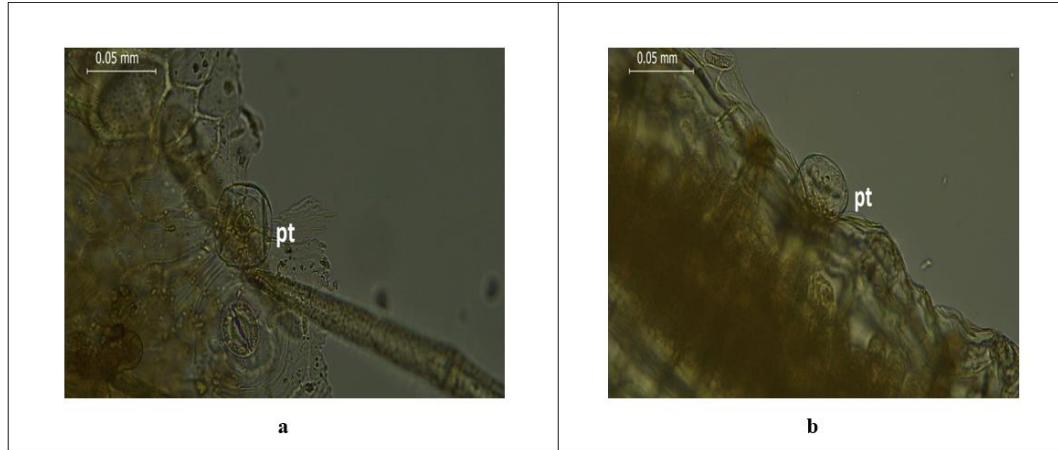


Figure 1. Peltate (Type I) trichomes of *T. orientale* var. *orientale* on superficial section of leaf (a) and on cross section of leaf (b) pt: peltate trichome

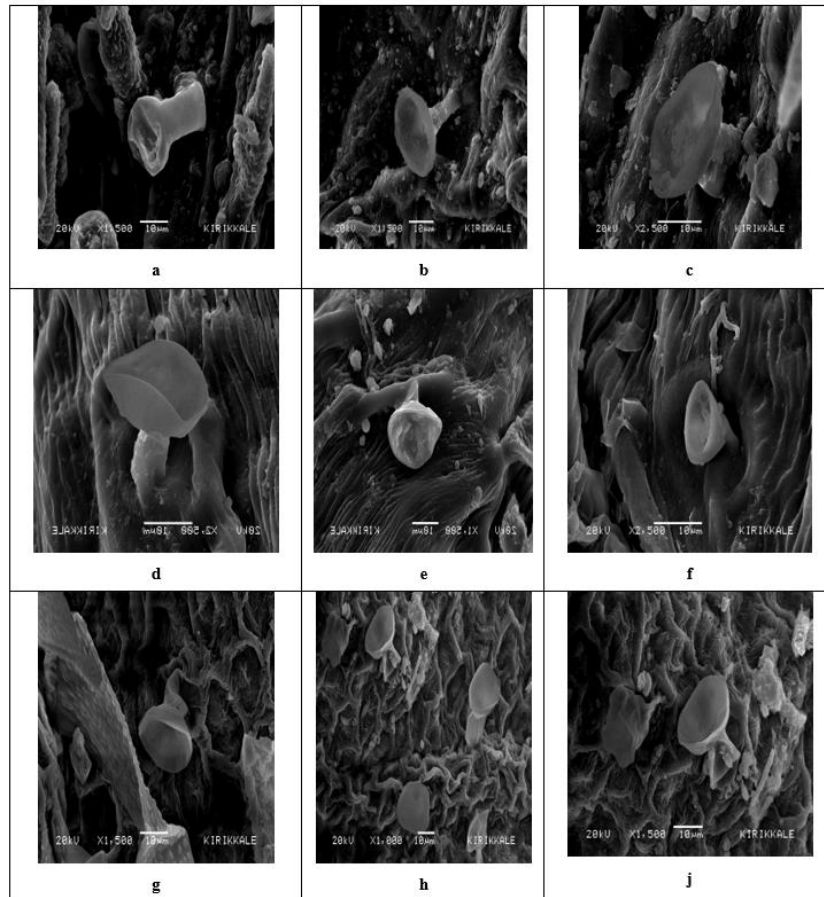


Figure 2. Capitate glandular (Type II) trichomes of *T. orientale* var. *orientale* on vegetative and reproductive organs. Subtype IIA on stem (a) Subtype IIB on leaf (b, c) Subtype IIB on calyx (d, e, f) Subtype IIB on corolla (g, h, j)

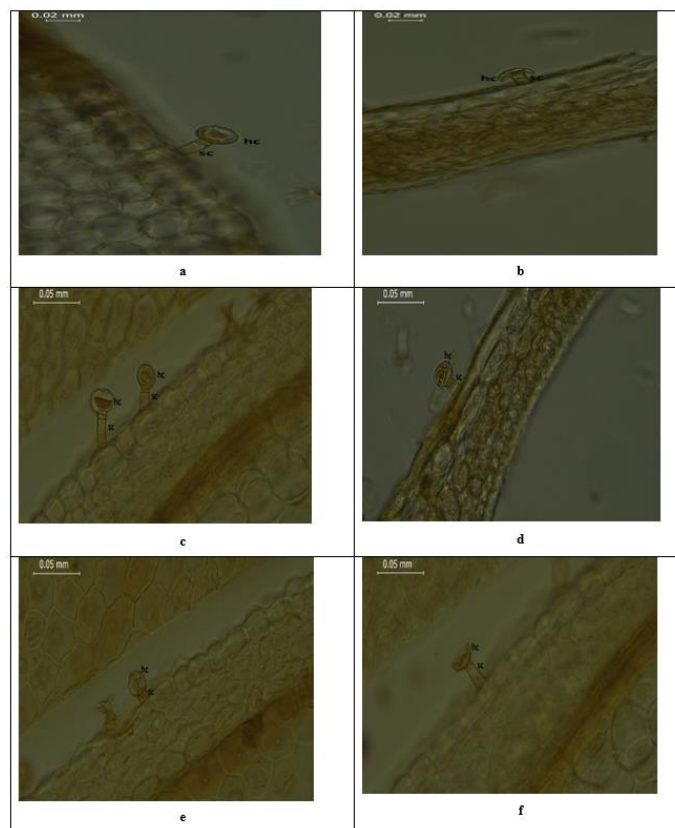


Figure 3. Capitate glandular (Type II) trichomes of *T. orientale* var. *orientale* on reproductive organs. Subtype IIA on corolla (a, c, e) and on calyx (d) Subtype IIB on corolla (f) Subtype IIC on calyx (b) hc: head cell sc: stalk cell

CONCLUSION

In conclusion, the paper is the first information about glandular trichomes of *T. orientale* var. *orientale*. Glandular trichomes have taxonomic importance in species of Lamiaceae because they have importance for infrageneric classification for *Teucrium*. *T. orientale* var. *orientale* had both peltate and capitate glandular trichomes. Peltate ones had four head cells and these trichomes were seen both vegetative and reproductive organs. Capitate glandular ones had three subtypes. These were subtype IIA, subtype IIB and subtype IIC capitate glandular trichomes. Subtype IIA and subtype IIB were seen on both vegetative and reproductive organs, whereas subtype IIC was observed on only reproductive ones. It was thought that all information on glandular trichomes of the species determined in this study could be useful for taxonomy of the plant in the future.

CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

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