



Full Length Article

Glandular Trichomes in *Marrubium cephalanthum* ssp. *montanum* (Lamiaceae) Growing in Turkey

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Abstract

In the present investigation, glandular trichomes on the several organs of endemic *Marrubium cephalanthum* Boiss. and Noë ssp. *montanum* Akgül and Ketenoglu (Lamiaceae) were examined to comprehend the important characteristics for systematic purposes. Two main types of glandular trichomes were described. These are capitate (type I) and peltate glandular (type II) trichomes. The capitate trichomes are subdivided into four subtypes as a subtype IA, subtype IB, subtype IC and subtype ID. Generally, these trichomes consist of one or two-celled head and one or two-celled stalk. Peltate trichomes have eight-celled head in a single circle. Subtype IA and peltate trichomes are seen abundantly on all organs of the species. While subtype IB and subtype IC are rare on the same organs, subtype ID is densely distributed on the leaf, petiole and calyx. © 2017 Friends Science Publishers

Key words: Glandular trichome; *Marrubium cephalanthum* ssp. *montanum*; Endemic; Lamiaceae

Introduction

Marrubium L. genus has annual and perennial herbs. This genus includes approximately 40 taxa (Akgül *et al.*, 2008). There are 21 species of genus *Marrubium* L. in Turkey (Aytaç *et al.*, 2012), while 15 species of the genus are distributed in Iran, 14 species in former USSR countries and 12 species in Europe (Tutin and Heywood, 1964-1980; Komarov, 1964). Turkey is an important gene centre of the genus because of the high endemism level (57%).

Marrubium L. genus is characterized with having stamens, which are included in the corolla tube, calyx throat bearded and corolla tube with a ring of hair inside, erect or ascending stems and densely hairy, having many lateral branches, leave with toothed margins. The genus is also characterized by stellate trichomes, which cover all plant parts. Some species of the genus such as *M. vulgare* are used for medical purposed.

In Lamiaceae family, one of the most important and useful characters for identification of the genera and species is trichomes (Serpooshan *et al.*, 2014; Seyedi and Salmaki, 2015). The structure of trichomes show a range of variation in this family. Simple glandular, non-glandular and peltate are the most common types of trichomes, but stellate and branched trichomes are also characteristic of some genera.

In this study, the glandular trichomes of *M. cephalanthum* Boiss. and Noë ssp. *montanum* Akgül and Ketenoglu, a new endemic subspecies in the Flora of Turkey, was examined for the taxonomic purposed in the genus. The trichome properties were used for taxonomical

purposed in the Lamiaceae family (Metcalf and Chalk, 1972). It was aimed to determine the glandular trichome properties in the species for taxonomic purposed.

Materials and Methods

Plant materials of *Marrubium cephalanthum* Boiss. and Noë ssp. *montanum* Akgül and Ketenoglu investigated for this paper were collected in Amasya, May 2015. The specimens were kept as a herbarium material. Flora of Turkey was used for its taxonomical description (Davis, 1982).

M. cephalanthum ssp. *montanum* samples were fixed in 70% alcohol for trichome examination. Glandular trichomes were got from vegetative and reproductive organs of *M. cephalanthum* ssp. *montanum*. The glandular trichome preparations were prepared by hand using commercial razor blades under a binocular light microscope. Sartur reagent was applied to the sections for investigation of some anatomical tissues (Çelebioğlu and Baytop, 1949). The glandular trichome types and distributions were described. These types studied in this paper were classified following the procedure of Metcalfe and Chalk (1972).

Results

Glandular Trichome Morphology

M. cephalanthum ssp. *Montanum* has had capitate and peltate trichomes on the several organs (Table 1). Type I trichomes had a basal epidermal cell, unicellular to

multicellular stalk cell and a large unicellular, bicellular or multicellular head. In the study, four subtypes of capitate glandularones were recognized. Subtype IA: A globose unicellular or bicellular head and a stalk of one to two cells (Fig. 1a, b). Subtype IB: A cup-shape unicellular head an one to two-celled stalk (Fig. 1c, d). Subtype IC: A hemispherical unicellular head and a unicellular or bicellular stalk (Fig. 1e). Subtype ID: An oblong unicellular head and a short unicellular stalk, sometimes bicellular stalk (Fig. 1f-h).

Another glandular trichome type is peltate (Type II) trichome, which has a basal epidermal cell, a very short monocellular stalk and a broad, round multicellular secretory head consisting of eight cells in the single shield i.e., one central cell covered by 8 cells (Table 1; Fig. 2a, b).

Distribution of the Glandular Trichomes

M. cephalanthum ssp. *montanum* possesses many subtype IA capitate glandular trichomes on all organs, while subtype IB is rare on the same organs (Table 2). On the other hand, subtype IC capitate trichomes were observed only on the petiole, whereas subtype ID was densely spread on the leaf, petiole and calyx. The peltate (type II) trichomes were seen on all organs of the species (Table 2).

Discussion

In recent years, trichomes have significant value, because of using in plant taxonomy. Capitate ones are seen frequently in Lamiaceae. They possess one or two stalk cells forming a rounded to secretory head (Bosabalidis, 1990). In the study, these trichomes are subdivided into four subtypes. These are subtype IA, subtype IB, subtype IC and subtype ID. The same subtypes were determined in another species of Lamiaceae family (Serrato-Valenti *et al.*, 1997). Subtype IA is the most common and observed on all organs of *M. cephalanthum* ssp. *montanum*. Subtype IB and subtype IC are rare on the same organs, but subtype ID is densely distributed on the leaf, petiole and calyx. Capitate glandular trichomes are important systematic properties and play significant function for pollination in Lamiaceae (Navarro and El Oualidi, 2000).

In the present study, *M. cephalanthum* ssp. *montanum* possesses peltate ones having eight celled head in a single circle. Some species of Lamiaceae family have the peltate ones with a four or twelve-celled head in a single circle, which is agreement with another study (Kamatou *et al.*, 2006). Despite their common occurrence, peltate trichomes are not observed in some Lamiaceae family (Karousou *et al.*, 1992). Besides, some researcher reported that these trichomes were found abundantly on the vegetative organs of some species in Lamiaceae, whereas the same trichomes were rare on the reproductive organs (Serrato-Valenti *et al.*, 1997). In this study, peltate trichomes were seen abundantly on all organs of *M. Cephalanthum* ssp. *montanum*.

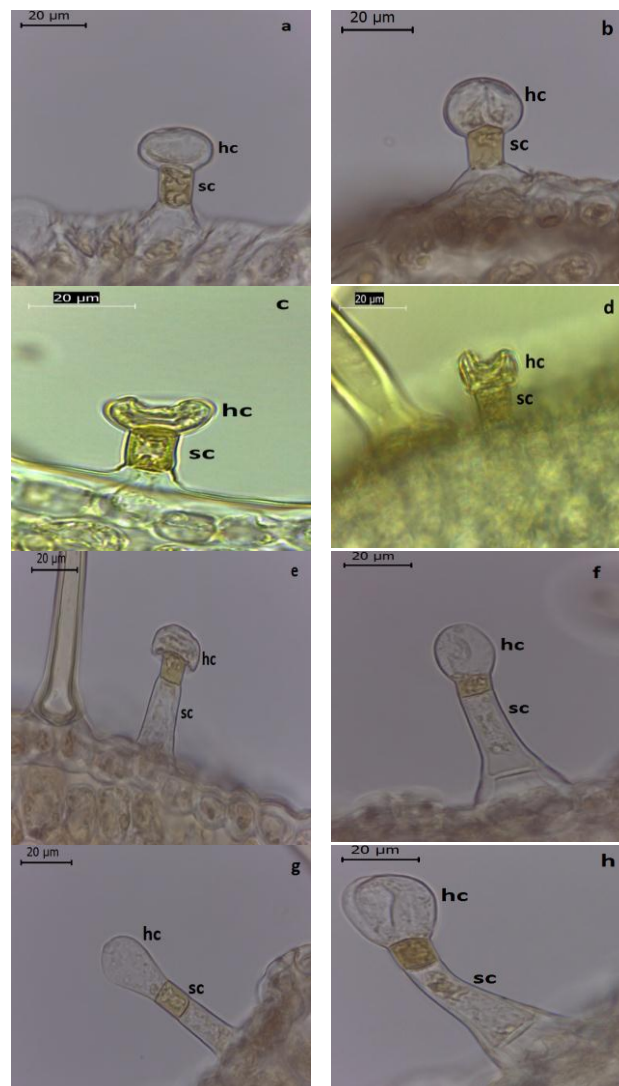


Fig. 1: Capitate glandular (type I) trichomes. Subtype IA on petiole (a, b) hc: head cell sc:stalk cell. Subtype IB on calyx (c) and on stem (d) Subtype IC on petiole (e) Subtype ID on petiole (f-h)

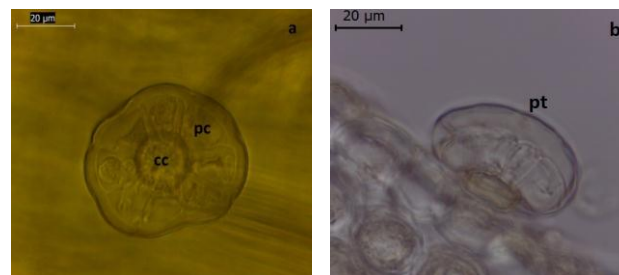


Fig. 2: Peltate trichomes (type II) of *M. cephalanthum* on the surface section of calyx. (a) and cross section of petiole (b) cc: center cell, pt: peltate trichome, pc: peryphery cell

Table 1: Glandular trichome types of various organs of *M. Cephalanthum*

Plant part	Capitate type (Type I)												Peltate type	
	Type IA			Type IB			Type IC			Type ID			Center cell	Periphery cell
	Head cell	Stalk cell	Base cell	Head cell	Stalk cell	Base cell	Head cell	Stalk cell	Base cell	Head cell	Stalk cell	Base cell		
Stem	1	1	1	1	1	1	-	-	-	1	1	1	1	8
	1	2	1	-	-	-	-	-	-	1	2	1	-	-
Leaf	1	1	1	1	1	1	-	-	-	1	1	1	1	8
	1	2	1	-	-	-	-	-	-	1	2	1	-	-
Petiole	1	1	1	1	1	1	1	1	1	1	2	1	1	8
	2	1	1	1	2	1	1	2	1	-	-	-	-	-
	1	2	1	-	-	-	-	-	-	-	-	-	-	-
Calyx	1	1	1	1	1	1	-	-	-	1	1	1	1	8
	1	2	1	1	2	1	-	-	-	-	-	-	-	-
	2	1	1	-	-	-	-	-	-	-	-	-	-	-
Corolla	1	1	1	1	1	1	-	-	-	-	-	-	1	8
	2	1	1	1	2	1	-	-	-	-	-	-	-	-
	1	2	1	-	-	-	-	-	-	-	-	-	-	-

Table 2: Distribution of peltate and capitate ones on various organs of *M. cephalanthum*

Plant organ	Peltate (Type II)	Capitate (Type I)							
		Type IA (Stalk 1-2 cells)		Type IB (Stalk 1-2 cells)		Type IC (Stalk 1-2 cells)		Type ID (Stalk 1-2 cells)	
		1	2	1	2	1	2	1	2
Stem	++	+++	+++	+	-	-	-	-	-
Adaxial leaf surface	-	+	-	-	-	-	-	+	+
Abaxial leaf surface	++	+++	+++	+	-	-	-	++	+
Petiole	+++	+++	+++	+	+	+	+	-	++
Calyx	++	+++	+++	+	+	-	-	++	-
Corolla	+	+++	+++	+	+	-	-	-	-

(-), (+), (++) and (+++) denotes absence, a few and a lot of trichomes, respectively

Presence of glandular trichomes, especially on the flowers of *M. cephalanthum* ssp. *montanum*, is a noteworthy finding. The presence of these trichomes on reproductive organs of Lamiaceae family has also been reported (Werker *et al.*, 1985). The specific function of these peltate and glandular ones is uncertain yet. The secretion of these trichomes may attract pollinators or to protect against predators.

Conclusion

This study is the first report on the glandular trichomes of endemic *M. cephalanthum* ssp. *montanum* provided significant information on the glandular trichome characters of the plant. A great diversity of plant trichomes has taxonomic significance in Lamiaceae family. Therefore, many botanists are interested in adaptive and taxonomic value of trichomes because these values are used at subfamilial level in Lamiaceae. These results can be used to separate the species from another species in Lamiaceae family. The structure and distribution of glandular trichome give useful properties for separating the species in Lamiaceae family.

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