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Research Article

Trichomes on Vegetative and Reproductive Organs of Endemic *Ballota macrodonta* (Lamiaceae)

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Abstract

The morphological features and distributions of trichomes on both vegetative and reproductive organs of endemic *Ballota macrodonta* were examined in this study. The species has limited distrubution in Türkiye and is endemic Iranian Turanian element. In this taxon, different trichome types were seen and these trichomes were divided into two main groups. The first group forms eglandular trichomes, the other group forms glandular trichomes. Two types of eglandular trichomes were obtained on the vegetative and reproductive organs of the taxon: simple unbranched and branched. Stellate type of branched eglandular trichomes were seen more frequently on the lower surface, margins, veins of leaves, corolla, and outer part of calyx, while long unicellular, bicellular, tricellular and multicellular types of simple unbranched eglandular trichomes were seen more frequently on all the organs of this taxon. Glandular trichomes were categorized as capitate with different stalk lengths and one–two head cells and peltate with four–eight secretory cells. According to number of stalk cells, capitate trichomes were grouped into as unicellular, bicellular, tricellular and multicellular trichomes. The capitate ones were seen nearly on all organs of *B. macrodonta*. Peltate trichomes were rarely found on the stem, upper surface of leaf and corolla, while these trichomes were densely found on the surface of the calyx. It was emphasized that both simple unbranched and stellate eglandular trichomes could be used as valuable characters in the classification of this species.

Keywords: *Ballota macrodonta*, endemic, trichome morphology, Türkiye.

Endemik *Ballota macrodonta*'nın (Lamiaceae) Vejetatif ve Üreme Organları Üzerindeki Tüyler

Öz

Bu çalışmada, endemik *Ballota macrodonta*'nın hem vejetatif hem de üreme organları üzerindeki tüylerin morfolojik özellikleri ve dağılımları incelendi. Tür, Türkiye de limitli yayılışa sahiptir ve endemik Iran-Turan elementidir. Bu taksonda, farklı tüy tipleri görüldü ve bu tüyler iki ana gruba ayrıldı. Birinci grup örtü tüylerini oluşturur, diğer grup salgı tüylerini oluşturmaktadır. Taksonun vejetatif ve üreme organları üzerinde örtü tüylerinin iki tipi bulundu: basit dallanmamış ve dallanmış. Basit dallanmamış örtü tüylerinin uzun bir hücreli, iki hücreli, üç hücreli ve çok hücreli tipleri bu taksonun bütün organları üzerinde daha sık görülürken, dallanmış örtü tüylerin yıldızsı tipine yaprakların alt yüzeyinde, yaprakların damarları ve kenarlarında, korolla ve kaliks'in dış yüzeyinde daha sık görüldü. Salgı tüyleri farklı sap uzunluklarına ve bir-iki baş hücreye sahip kapitat ve dört-sekiz salgı hücresine sahip peltat olarak kategorize edildi. Sap hücre sayılarına göre, kapitat tüyler bir hücreli, iki hücreli, üç hücreli ve çok hücreli olarak gruplandırıldı. Kapitat olanlar *B. macrodonta*'nın hemen hemen bütün organlarında görüldü. Peltat tüyler nadir olarak gövdede, yaprağın üst yüzeyinde ve korolla da nadir olarak bulunurken, bu tüyler kaliks yüzeyinde yoğun olarak bulundu. Bu türün sınıflandırılmasında hem basit dallanmamış hem de yıldız şeklindeki örtü tüylerinin değerli karakterler olarak kullanılabileceği vurgulandı.

Anahtar Kelimeler: *Bollata macrodonta*, endemik, tüy morfolojisi, Türkiye

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1. Introduction

Lamiaceae family is recognized as a medicinal aromatic plant family due to its high chemical compounds [1]. Türkiye is an important gene center of the Lamiaceae family and this family is represented by 45 genera, 581 species and 751 taxa [2].

Ballota L. genus is known to be important medicinal plants belonging to the Lamiaceae family. Specially, the aerial parts of taxa are widely used in traditional medicine. *Ballota* genus is represented by 35 species and 14 subspecies in the temperate regions of Europe, North Africa and West Asia in the world. 12 species and 8 subspecies of this genus are distributed in Türkiye [2-4]. This genus is rich in endemic species (72.7%) and has a high diversity, especially in the Mediterranean Basin. In Türkiye, *Ballota* species are known with names such as shalba, calba, balotu, honeygrass, nemnem grass, nettle, aerobatic grass, dog grass, black ground leek, hand-saving, smack grass, leylim kara, somruk and ant worm. Some species of the genus are used by the public for cough, asthma, diuretic, headache, nausea, hemorrhoids, wound and burns treatment [4-8]. *B. macrodonta* Boiss. et Balansa is a medicinal plant and reported to have strong antioxidant activity due to its rich phenolic content [9].

Trichomes can develop on the surface of all plant organs. The micromorphology of their provides significant information in the separation of species and subspecies of the Lamiaceae family [10-12]. Also, the importance of trichomes in taxonomy was emphasized by many researchers [12-16]. They are widely obtained on the vegetative and generative organs of taxa of the Lamiaceae family. According to different characteristics and functions, trichomes are grouped into single-celled or multicellular, branched or unbranched, and glandular or eglandular [17]. The glandular trichomes were recorded in four types; subsessile glandular, clavate glandular, branched glandular and capitate glandular trichomes [18]. The eglandular ones were identified with four types; simple unicellular, simple multicellular, branched unuicellular and branched multicellular [19]. The trichomes are known to act as a protective barrier in plant defense against abiotic and biotic stress, such as herbivores, parhogen attacks, seed spread, seed protection, ultraviolet (UV) irradiation, excessive transpiration, drought, salinity and he the presence of heavy metals [20, 21]. They play an important role in many plant-environment interactions, since they are at the outermost boundary between plant and environment. The morphology and distribution of trichomes are related to many factors and even the density distribution of trichomes can show changes in different organs of plants. Namely, the density of trichomes on the lower surface of the same leaf was significantly higher than that of the upper surface [22].

The micromorphology of trichomes is used as important taxonomic characters in distinguishing the species and genera of the Lamiaceae family, which includes the *Ballota* genus. The aim of this study is to emphasize the importance of the availability of trichomes as taxonomic

characters. In addition, *Ballota marodonta* is distinguished from other taxa of the *Ballota* genus according to its trichome morphology.

2. Materials and Methods

The plant materials were collected during the flowering period. Flora of Turkey was used for taxonomic description of the plant materials [2]. For the light microscopy observations (LM), some of fresh materials were fixed in 70 % alcohol solution. The ten different plant samples were used for trichome examinations. The cross and surface-sections of the vegetative (stem, leaf and petiole) and reproductive organs (flowers) were taken by hand using commercial razor blades. Preparations were prepared by taking fifteen surface and fifteen cross-sections from each of the vegetative and reproductive organs of different plant samples. Sartur reagent was applied to the cross and surface-sections [23]. For the stereo microscopy investigations, surface sections were taken from fresh samples and in 70 % alcohol solution samples. Temporary preparations were made and preparations were photographed with a binocular light microscope, with equiped camera and 40X objectives (Leica ICC50 HD). The classification of trichome types were identified according to Cantino [19] and Navarro and El Oualidi [18]. Trichome types and their distribution on the organs of the studied taxon were shown in Tables 1-3. The locality where plant materials were collected was given below;

C5 Kayseri: Yahyalı, Çamlıca-Ulupınar vicinity, sparse *Pinus brutia* forests, serpentine areas, 1112 m., 27. 07. 2021, N. Kandemir.

3. Results and Discussion

In the members of the Lamiaceae family, the presence of trichomes (especially glandular ones, but also eglandular ones) is significant characteristic features [24]. In this study, the types of glandular and eglandular trichomes and their distribution on the vegetative and reproductive organs of *B. macrodonta* were investigated for systematic purposes. Different types of both glandular and eglandular trichomes were identified on the vegetative and reproductive organs of the studied taxon. The two types of glandular trichomes were recorded; peltate and capitate glandular trichomes. The eglandular trichomes were identified with two types; branched (stellate) and simple unbranched trichomes.

3.1. Morphology and distribution of eglandular trichomes

3.1.1. Simple unbranced eglandular trichomes

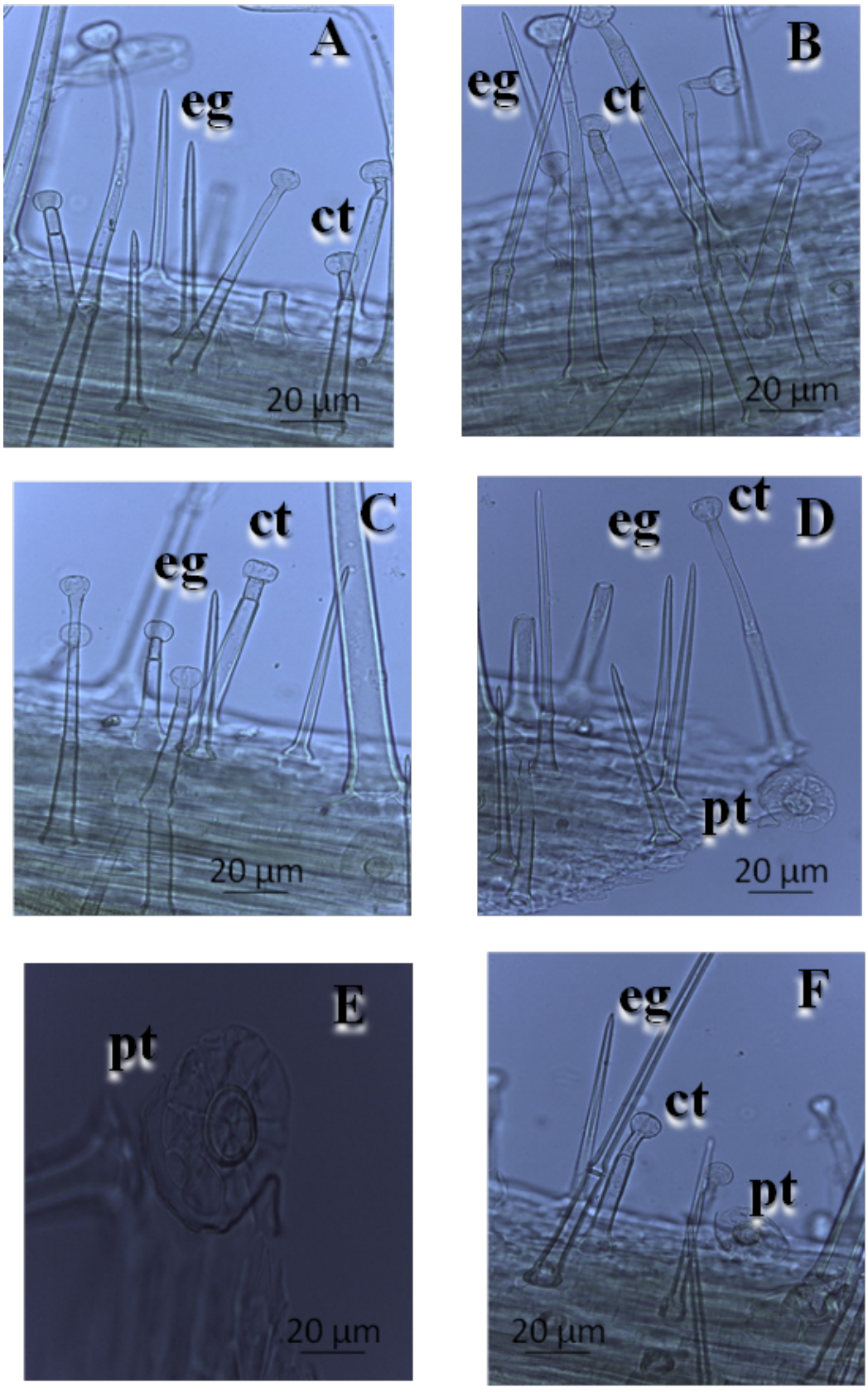
The simple unbranched eglandular trichomes were again divided into four subtypes (unicellular, bicellular, tricellular, multicellular trichomes) based on the number cell of stalk in this study. The multicellular trichomes were rarely observed on the leaf, calyx teeth, outside part of the calyx of *B. macrodonta*. However, the multicellular trichomes were densely observed on the stem, petiole and corolla of the taxon (Fig. 1 G; Fig. 2 F). This type of trichomes was detected on the petiole of *B. pseudodictamnus* (L.) Benth. subsp. *lycia* Hub.-Mor. [25], organs of *B. undulata* (Sieber ex Fresen.) Benth. [14] and the vegetative and reproductive organs of *B. glandulosisssima* Hub.-Mor & Patzak [12]. The long unicellular, bicellular and tricellular

trichomes were densely found on all organs of *B. macrodonta* (Figs. 1 A, C, D, F, H and M; Figs. 2 A, C, E, F, H, L, M and P). The long unicellular and bicellular trichomes were abundance seen on the calyx teeth of *B. macrodonta*, while long unicellular trichomes were adundance seen on the calyx surface (Table 1). Similar eglandular trichome types were also reported in some Türkiye species of the genus *Teucrium* L. [15], on the organs of *B. pseudodictamnus* (L.) Benth. subsp. *lycia* Hub.-Mor. in Türkiye [25], in *Phlomoides* taxa [26], *B. acetabulosa* (L.) Benth. [27], on the organs of *B. glandulosisssima* [12], on the leaves of *Phlomis herba-venti* subsp. *pungens* (Willd.) Maire ex DeFilipps. [28] and on the stem and leaves of *B. nigra* L. subsp. *nigra* [29]. Moreover, these trichomes were seen in *B. kaiseri* Tachk., *B. undulata B. saxatilis* Sieber ex J. Et C. Presl and *B. pseudodictamnus* [14].

3.1.2. Branched eglandular trichomes

Stellate trichomes are multicellular and branched structure. They are called as star-shaped trichomes [30]. The stellate trichomes have with 3–8 equal branches and surface of their can be smooth or rough. These trichomes were abudantly seen on the lower surface, margins and veins of leaves, outside part of the calyx and corolla of *B. macrodonta* (Figs. 2 D, G, K) (Table 1). Especially, this type of trichomes was highly dense on the lower surface of leaf of the studied taxon. The dense, short stellate trichomes are seen only in the ridge parts of corolla upper lip of *B. macrodonta*. On the petiole, stem and upper surface of leaf of the taxon, stellate trichomes were not observed. In addition, *B. macrodonta* has two different leaf colors depending on the presence and density of stellate trichomes on the upper and lower surfaces of the leaf. The upper surface of the leaf is not stellate trichomes and green in coloured, while the lower surface is densely stellate trichomes and white in coloured. The stellate trichomes were a common feature of *Ballota* taxa. El-Deen Osman [14] and Kandemir [12] reported presence of stellate trichomes in other *Ballota* taxa (*B. kaiseri, B. saxatilis, B. undulata* and *B. glandulosissima*), respectively. Also, this type of trichomes were recorded in *Phlomoides* taxa [26] and *Marrubium astracanicum* subsp. *astracanicum* Jacq. [16].

In the Lamiaceae family and the *Ballota* genus are mostly known for its stellate and dendroid trichomes. In the studied taxon, dendroid trichomes were seen neither on the vegetative nor reproductive organs of this taxa. Also, this kind of trichomes was not found in some *Ballota* species (*B. kaiseri, B. saxatilis, B. undulata*) growing in Egypt [14]. The dendroid ones were found in *B. acetabulosa* (L.) Bentham., *B. pseudodictamnus* subsp. *lycia* and *B. cristata* P.H. Davis distributed in Türkiye [25,31] and *B. damascens* Boiss., and *B. pseudodictamnus* distributed in Egypt [14]. On the other hand, Giuliani et al. [27] and Kandemir [12] did not detect the dendroid trichomes on the organs of *B. acetabulosa* and *B. glandulosissima*, respectively. Since the presence of dendroid and stellate trichomes had systematic value for taxa division, some *Ballota* taxa (*B. kaiseri, B. saxatilis, B. undulata and B. pseudodictamnus*) in Egypt were distinguished according to the presence or absence of stellate and dendroid trichomes by El Deen Osman [14].



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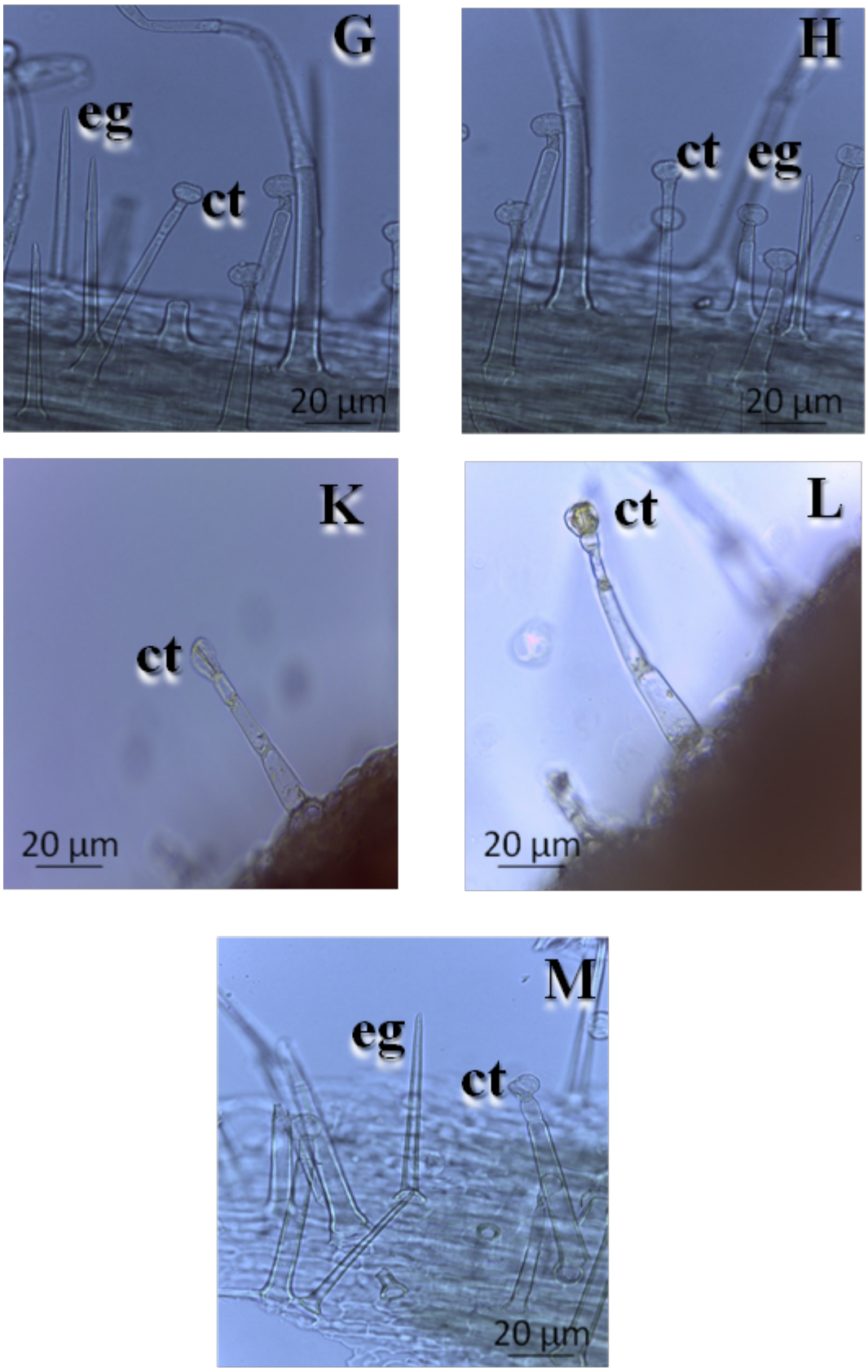


Figure 1. Glandular and eglandular trichome types on the stem and petiole. (A) Unicellular eglandular and bicellular, tricellular stalked with unicellular head capitate trichomes on the stem, (B) Unicellular, bicellular

eglandular and bicellular, tricellular, multicellular stalked with unicellular head capitate trichomes on the petiole, (C) Unicellular eglandular and unicellular, tricellular stalked with unicellular head capitate trichomes on the stem, (D) Unicellular eglandular and unicellular, multicellular stalked with unicellular head capitate and peltate trichomes on the stem, (E) Peltate trichomes on the stem, (F) Bicellular, unicellular eglandular and bicellular stalked with unicellular head capitate and peltate trichomes on the stem, (G) Unicellular, multicellular eglandular and bicellular, multicellular stalked with unicellular, bicellular head capitate trichomes on the stem, (H). Multicellular, bicellular stalked with unicellular, bicellular head capitate and unicellular eglandular trichomes on the stem, (K) Tricellular swollen stalked with bicellular head capitate trichomes on the petiole, (L) Multicellular swollen stalked with bicellular head capitate trichomes on the stem, (M) Unicellular eglandular and bicellular and multicellular stalked with unicellular head capitate trichome on the petiole, (eg) Eglandular trichomes, (ct) Capitate trichomes, (pt) Peltate trichomes.

Table 1. Eglandular trichome types and distribution on the vegetative and reproductive organs of *Ballota macrodonta*.

Organs of *Ballota macrodonta*	**Unbranched unicellular**	**Unbranched bicellular**	**Unbranched tricellular**	**Unbranched multicellular**	**Stellate trichomes**	**Dendroid trichomes**
Stem	++	++	++	++	_	_
Petiole	++	++	++	++	_	_
Margin and veins of leaf	++	++	++	+	+++	_
Lamina of leaf (upper surface)	++	++	++	+	_	
Lamina of leaf (lower surface)	++	++	++	+	+++	_
Calyx teeth	+++	+++	++	+	_	_
Outer surface of calyx	+++	++	++	+	+++	_
Corolla	++	++	++	++	+++	_

-: absent; **+:** scarce; **++:** dense; **+++:** abundant

3.2. Morphology and distribution of glandular trichomes

The two different types of glandular trichomes were detected on vegetative and reproductive organs of *B. macrodonta*–capitate and peltate trichomes. These trichomes were sessile, short stalked or long stalked. The glandular ones and their distribution, morphological shapes and frequency provide valuable characters at subfamily level in the Lamiaceae family [22].

3.2.1. Capitate glandular trichomes

The capitate glandular trichomes are the most common in the Lamiaceae family and they can be used for taxonomic identification of taxa in this family. However, the stalk length and head shape of these trichomes are very variable. This kind of trichomes were reported on the vegetative and reproductive organs of some Lamiaceae taxa [12, 16, 26, 28, 32]. In the present

study, capitate glandular trichomes in *B. macrodonta* were divided into four subtypes which were unicellular long or short stalked (subtype I), bicellular (subtype II), tricellular (subtype III) and multicellular (subtype IV) stalked.

3.2.1.1. Unicellular stalked capitate glandular trichomes (Subtype I)

These trichomes have a stalk cell and unicellular, bicellular, tricellular and multicellular head. Therefore, this type of capitate trichomes is classified as unicellular, bicellular, tricellular and multicellular headed trichomes, according to number of head cells. In the present study, two form of these trichomes were recognized (Table 3). The first form was unicellular headed and was seen on the stem, petiole, upper and lower surface of leaf, outside part of the calyx, calyx teeth and corolla of this taxon (Figs. 1 C, D). The second form had bicellular head and was rarely observed on the petiole, stem, calyx teeth, lower surface of leaf of *B. macrodonta* (Table 2). The unicellular stalked capitate trichomes were found on the stem and leaves of *B. nigra* subsp. *nigra* [29], the vegetative and reproductive of *B. glandulosissima* [12], in *B. kaiseri, B. undulata, B. damascens, B. saxatilis, B. pseudodictamnus* [14], in some Turkish species of *Teucrium* [15], the organs of *B. pseudodictamnus* subsp. *lycia* [25] and the organs of *Phlomis herba-venti* subsp. *pungens* [28]. Also, these trichomes were seen especially on the leaf and corolla abaxial sides, on the vein system of the whole plant, of *B. acetabulosa* [27]. On the other hand, the unicellular stalked capitate ones were quite widespread in all taxa of the Lamiaceae family [33, 12, 16, 22, 28, 33].

3.2.1.2. Bicellular stalked capitate trichomes (Subtype II)

The stalk was two celled, head had one or two cells (Table 3). These trichomes had also a long or short neck cell. On the leaves, stem, petiole, calyx and calyx teeth of *B. macrodonta*, unicellular and bicellular headed of these capitate trichomes were found (Figs. 1 A, B, F, G, H and M; Figs. 2 B, C, F, H, L, M and P) (Table 2). This kind of trichomes was quite dense on the stem. These capitate trichomes were determined in some members of the genera *Salvia* L., *Stachys* L., *Sideritis* L., *Scutellaria* L., and *Ballota* [12, 29, 33-35]. Moreover, bicellular stalked capitate ones were detected in *B. kaiseri, B. undulata, B. damascens, B. saxatilis,* and *B. pseudodictamnus*) [14] and on leaves and the calyx abaxial side of *B. acetabulosa* [27], on the leaves of some Turkish species of *Teucrium* [15] and on the organs of *B. pseudodictamnus* subsp *lycia* [25].

3.2.1.3. Tricellular stalked capitate trichomes (Subtype III)

In the subtype III capitate trichomes, there are three celled long stalk, unicellular, bicellular head and a long or short neck cell. This type of capitate trichomes was obtained on the petiole, stem, lower surface of leaf, calyx and calyx teeth of *B. macrodonta* (Figs. 1 A-C; Figs. 2 B, F,). Stalk cells of this type trichome were swollen (Fig. 1 K). Although the tricellular stalked and unicellular, bicellular headed capitate trichomes were rarely seen on the stem, petiole, outside part of the calyx and calyx teeth of *B. macrodonta*, these trichomes were densely seen on the lower surface of leaf. This type of trichomes were observed on the leaf adaxial side, on the sepal abaxial side and on the floral peduncle of *B. acetabulosa* [27], the organs of some *Ballota* taxa

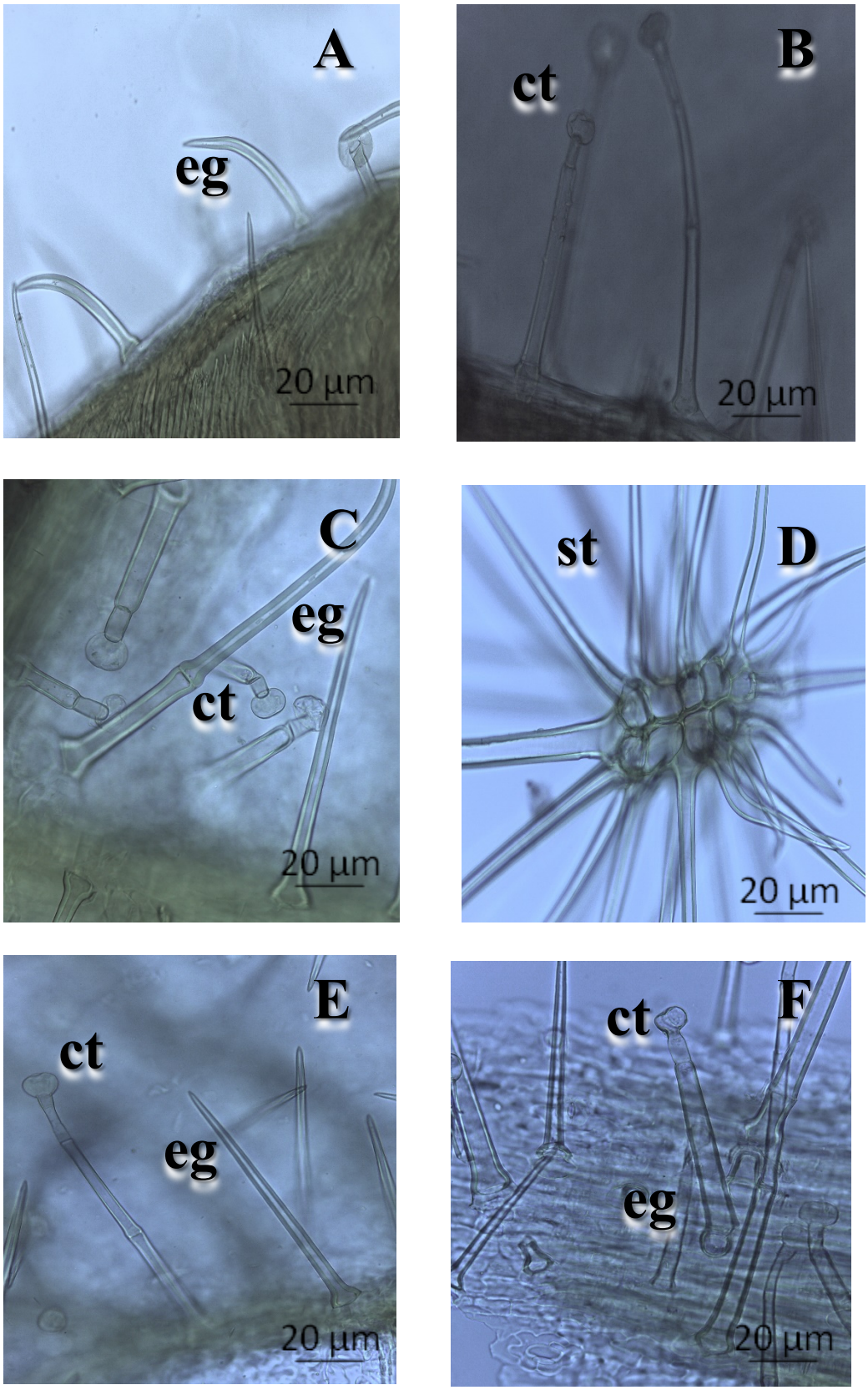
(*B. nigra subsp. nigra*, *B. kaiseri, B. undulata, B. damascens, B. saxatilis, B. pseudodictamnus, B. glandulosissima*) [29, 14, 12], respectively.

3.2.1.4. Multicellular stalked capitate trichomes (Subtype IV)

The stalk in this type of trichomes had multicellular (four, five and six celled). The head part of this trichome was one or two celled. In this study, the stalk part of this kind of capitate trichomes was four-celled and head was one-celled. Multicellular stalked (subtype IV) trichomes were recorded on the stem, petiole, leaf and calyx of *B. macrodonta* (Figs. 1 B, D, G, H; Figs. 2 E, L, N). Stalk cells of multicellular trichomes were swollen (Fig. 1 L). Multicellular stalked capitate ones were found in only *B. saxatilis* and *B. kaiseri* [14], on the leaf adaxial side, the sepal abaxial side and the floral peduncle *B. acetabulosa* [27], the vegetative and reproductive organs *B. glandulosissima* [12], the stem and leaves of *B. nigra* subsp. *nigra* [29] and the reproductive organs of other Lamiaceae taxa [33], the leaves of *Teucrium* taxa [15] and in *Phlomoides* taxa [26].

3.2.2. Peltate glandular trichomes

The peltate trichomes in the Lamiaceae consist of a basal cell, a short stalk, and a large head of several secretory cells (up to 16) [36]. In this study, peltate trichomes were seven and eight celled (Table 3). The peltate ones were rarely seen on the stem, upper surface of leaf and outer surface of the calyx and corolla of *B. macrodonta* (Figs. 1 D-F). These trichomes were dense on the outer surface of the calyx. Such trichomes (peltate) were observed on the leaves, sepals and petals of *B. acetabulosa* [27], both vegetative and reproduvtive organs of *B. glandulosissima* [12], the stem and leaves of *B. nigra* subsp. *nigra* [29]. The presence of peltate trichomes was reported on organs of *B. pseudodictamnus* subsp *lycia* and the organs of *Scutellaria brevibracteata* subsp. *subvelutina* (Rech. f.) Greuter & Burdet [25, 27]. But, peltate trichomes were not found on the leaves of *P. herba-venti* subsp. *pungens* [28].



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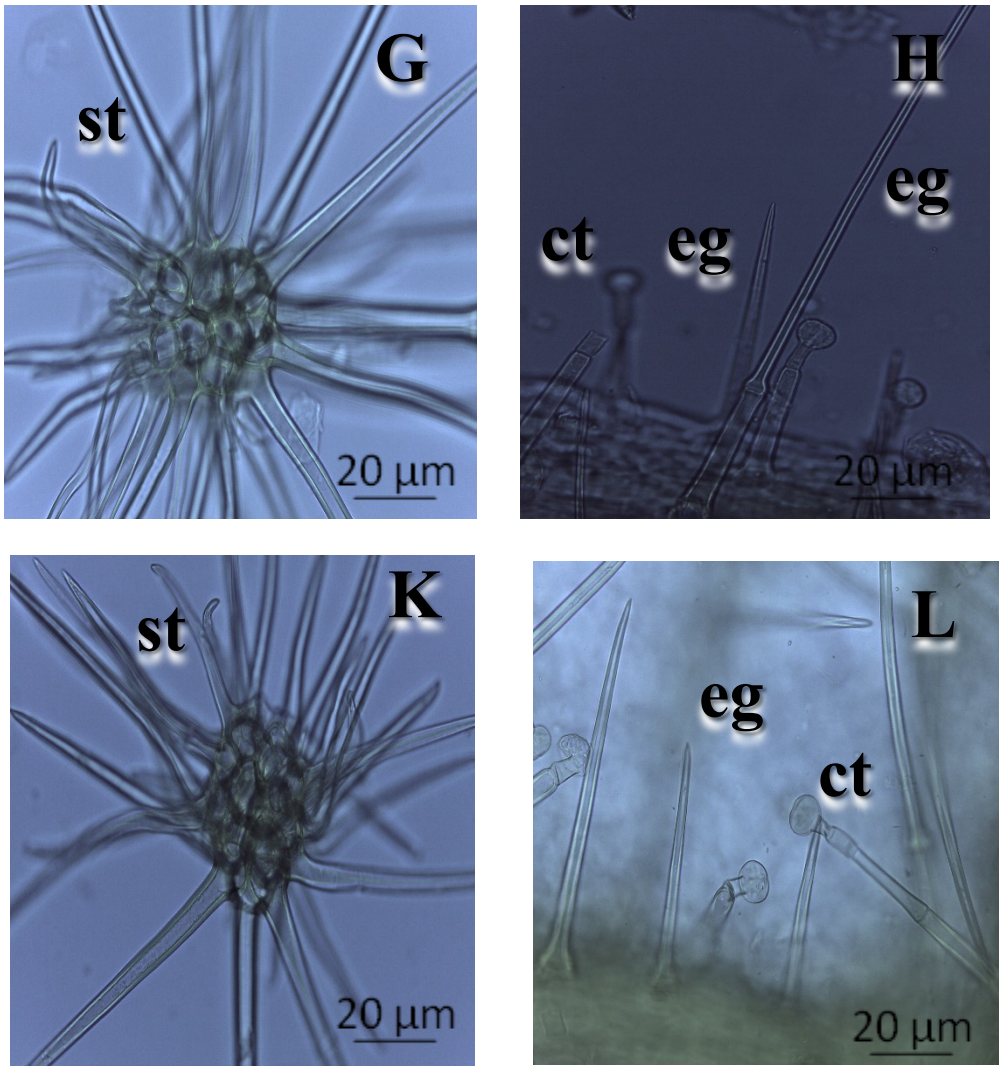

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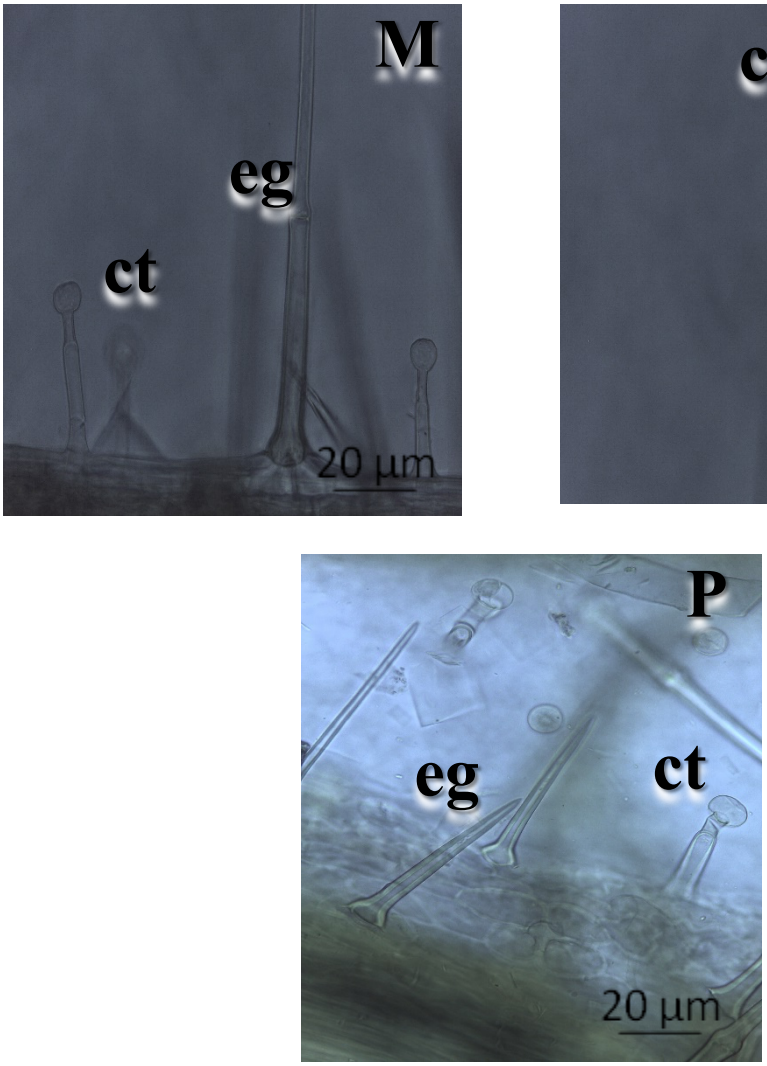

Figure 2. Glandular and eglandular trichome types on the leaf, calyx and corolla. (A) Unicellular eglandular trichomes on the calyx, (B) Bicellular and tricellular stalked with unicellular head capitate trichomes on the calyx, (C) Unicellular, bicellular eglandular and bicellular stalked with unicellular head capitate trichomes on the calyx, (D) Stellate trichomes on the calyx, (E) Unicellular eglandular and multicellular stalked with unicellular head capitate trichomes on the calyx, (F) Unicellular, multicellular eglandular and bicellular, tricellular stalked with unicellular head capitate trichomes on the calyx, (G) Stellate trichomes on the corolla, (H) Bicellular stalked with bicellular head capitate and unicellular, bicellular eglandular trichomes on the corolla, (K) Stellate trichomes on the leaf, (L) Unicellular, bicellular eglandular and bicellular, multicellular stalked with unicellular head capitate trichomes on the leaf, (M) Bicellular eglandular and bicellular stalked with unicellular head capitate trichomes on the leaf, (N) Multicellular stalked with unicellular head capitate trichome on the leaf, (P) Unicellular eglandular and bicellular stalked with unicellular head capitate trichomes on the leaf, (eg) Eglandular trichomes, (st) Stellate trichomes, (ct) Capitate trichomes.

Table 2. Glandular trichome types and distribution on the vegetative and reproductive organs of *Ballota macrodonta*

Organs of *Ballota macrodonta*	**Subtype I capitate**	**Subtype II capitate**	**Subtype III capitate**	**Subtype IV capitate**	**Peltate trichomes**
Stem	+	++	+	+	+
Petiole	+	+	+	+	_
Margin and veins of leaf	+	+	+	+	_
Lamina of leaf (upper surface)	+	+	_	_	+
Lamina of leaf (lower surface	+	+	++	_	_
Calyx teeth	+	+	+	_	_
Outer surface of calyx	+	+	+	+	++
Corolla	+	_	_	_	+

-: absent; **+:** scarce; **++:** dense; **+++:** abundant

Table 3. The stalk and head cell numbers of glandular trichomes on the vegetative and reproductive organs of *Ballota macrodonta*

	Capitate trichomes								**Peltate trichomes**	
Plant part	Subtype I		Subtype II		Subtype III		Subtype IV			
	Head cell	Stalk cell	Head cell	Stalk cell	Head cell	Stalk cell	Head cell	Stalk cell	Center cell	Periphery cell
Stem	1	1	1	2	1	3	1	4	1	7
	2	1	_	_	_	_	2	4	_	_
Petiole	1	1	1	2	1	3	1	4	_	_
	2	1	_	_	2	3	_	_	_	_
Leaf (upper surface)	1	1	1	2	_	_	1	4	1	8
Leaf (lower surface)	1	1	1	2	1	3	1	4	_	_
	2	1	_	_	_	_	1	4	_	_
Calyx	1	1	1	2	1					
						3	_	_	1	8
Corolla	1	1	_	_	_	_	_	_	1	8
	_	_	2	2	_	_	_	_	_	_

4. Conclusions

Trichomes are commonly used as value taxonomic characters in taxonomy of plants, since the distribution, density and types of trichomes show significant variability among different taxa. Also, Kandemir [12] and Gurdal [25] reported that trichome micromorphology can be useful in the taxonomy of the genus *Ballota.* On both the vegetative and reproductive organs of this taxon, four main trichome types (peltate glandular, capitate glandular, simple unbranched eglandular and branched eglandular) were seen. The unicellular, bicellular, tricellular and multicellular simple unbranced eglandular and stellate trichomes were densely observed on the vegetative and reproductive organs of this taxon. Specially, the densest trichome type was stellate ones and these trichomes were abundance seen on the lower surface and veins, leaf margins, corolla and outer part of calyx of the studied taxon. But, such trichomes did not observe on the upper surface of leaf, petiole and stem of this taxon. The simple unbranched eglandular and stellate trichomes were detected to having significant taxonomic characteristics in distinguishing from other *Ballota* taxa of *B. macrodonta*. On the other hand, *Ballota* taxa were characterized by the presence of stellate trichomes. Also, *B. macrodonta* can be easily distinguished from other species in *Ballota* genus by the presence of dense stellate trichomes on the lower surface of leaf. The capitate glandular trichomes were seen nearly all organs of the taxon, while peltate glandular trichomes were seen on the stem, upper surface of leaf and outer surface of the calyx and corolla. Especially the subtype II and subtype III types of capitate feathers were found more frequently on the organs of this taxon.

Ethics in Publishing

There are no ethical issues regarding the publication of this study.

Author Contributions

Designing the study, collecting data; evaluating the results, writing the article, etc. transactions were made by Nezahat Kandemir

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