Artvin Çoruh Üniversitesi
Mühendislik ve Fen Bilimleri Dergisi
Cilt:3 No:2, 2025 (132-147)

Artvin Coruh University
Journal of Engineering and Sciences
Vol:3 No:2, 2025 (132-147)

Araştırma Makalesi / Research Article-

Glandular Hairs of Aerial Organs on Some Salvia L. (Lamiaceae) Species in Turkey

Kadriye ŞENGÜLER[1*], Canan ÖZDEMİR[2]

[1]Alaşehir Vocational School, Department of Chemistry and Chemical Processing Technologies, Celal Bayar University, Manisa, Türkiye
[2]Department of Biology, Faculty of Art and Science, Celal Bayar University, Manisa, Türkiye
kadriye.senguler@cbu.edu.tr, cozdemir13@gmail.com

Received/Geliş Tarihi: 09.07.2025 **Accepted/Kabul Tarihi:** 29.12.2025

Abstract: The aim of this study was to determine the diversity of glandular hairs on the above-ground organs of eight *Salvia* species. The glandular hairs on the stems, leaves, bracts, petioles, calyces, and corollas of the endemic species *S. wiedemannii*, *S. tchihatcheffii*, *S. blepharochlaena*, and *S. cryptantha*, as well as *S. suffruticosa*, *S. cadmica*, *S. multicaulis*, and *S. microstegia*, were stained with safranin and fast green and examined under a light microscope. Number of cells in the central and peripheral regions of peltate glandular hairs, and in the head, stalk and base of capitate glandular hairs, were determined. *S. cadmica* and *S. blepharoclaena* exhibited the highest density and diversity of glandular hairs. Among the studied species, *S. tchihatcheffii* and *S. suffruticosa* showed the lowest diversity and number of glandular hairs. In the present study, an exhaustive examination of all above-ground parts of the species was conducted, and the resulting data will provide useful guidance for future studies on the trichome types and distribution of *Salvia* species, particularly in terms of intragenus classification.

Keywords: Glandular Hairs, Lamiaceae, Salvia

Türkiye'deki Bazı Salvıa L. (Lamıaceae) Türlerindeki Toprak Üstü Organlarının Salgı Tüyleri

Özet: Bu çalışmada, sekiz *Salvia* türünün toprak üstü organlarındaki salgı tüylerinin çeşitliliği ortaya konmaya çalışılmıştır. Endemik türler olan *S. wiedemannii*, *S. tchihatcheffii*, *S. blepharochlaena* ve *S. cryptantha* ile *S. suffruticosa*, *S. cadmica*, *S. multicaulis* ve *S. microstegia* türlerinin gövde, yaprak, brakte, petiyol, kaliks ve korolla kısımlarındaki glandular tüyler, safranin ve fast green ile boyanarak ışık mikroskobu altında incelenmiştir. Peltat salgı tüylerinin merkezi ve periferik hücre sayıları ile kapitat salgı tüylerinin baş, sap ve taban hücre sayıları belirlenmiştir. *S. cadmica* ve *S. blepharoclaena* türleri, glandular tüylerin en yüksek yoğunluğu ve çeşitliliğini göstermiştir. İncelenen türler arasında, *S. tchihatcheffii* ve *S. suffruticosa* ise glandular tüylerin en düşük çeşitliliği ve sayısını sergilemiştir. Bu çalışmada, türün tüm toprak üstü kısımlarının kapsamlı bir incelemesi yapılmış ve elde edilen veriler, *Salvia* türlerinin trikom tipleri ve dağılımı üzerine yapılacak gelecekteki çalışmalar için özellikle cins içi sınıflandırma açısından faydalı bir rehber niteliği taşıyacaktır.

Anahtar Kelimeler: Salgı Tüyleri, Lamiaceae, Salvia

1. Introduction

The majority of aromatic plant species in the Lamiaceae family are classified within the Nepetoideae subfamily, including *Salvia* species (Bisio et al., 1999). *Salvia* taxa are characterised by having the most abundant glandular hairs in the family (Metcalfe and Chalk, 1972). Capitate glandular trichomes are of taxonomic significance and integral to the specialised floral properties that facilitate pollination in Lamiaceae (Cantino, 1990; Mraz, 1998; Navarro and El Oualidi, 2000). Glandular trichomes are a vital part of a plant's defence mechanisms, acting as a physical barrier against insects, pathogens and other plants. They are likely to be involved in chemical defence due to their secretion of alkaloids, which are toxic to herbivores, and essential oils containing toxic monoterpenes. They have also been

*: Sorumlu Yazar (Corresponding Author)

observed to possess mechanical defence mechanisms, which are likely to include sticky non-cellulosic polysaccharides. They have also been observed to defend against other plants by secreting essential oils containing potent allelopathic agents (Bottega and Corsi, 2000). This study presents the first comparative dataset of organ-based capitate and peltate trichome cell counts for eight *Salvia* species found in Turkey as illustrated in Tables 2-6.

2. Material and Method

The plant materials were collected from their natural habitats during the flowering season between 2004 and 2017 (Table 1). To conduct anatomical studies, the specimens were preserved in 70% ethanol. Tissue sections were carefully excised by hand and subsequently stained with safranin and fast green. Cross-sections of the samples were then photographed using a motorized Leica DM 3000 microscope using 63 x magnification.

Table 1. Collection locations of Species

Species	Collection Locations
S. wiedemannii Boiss.	Ankara: Bala, Beynam national park, under forest, 1200 m, 14.vi.2004, Ozkan 4035
S. tchihatcheffii Fisch.	Ankara: between Ankara and Polatlı, roadside, 50 km, rocky slopes 1000 m, 05.vi.2004, Özkan 4028
S. suffruticosa Montbret & Aucher ex Bentham	Ankara: Bala, Beynam national park, under forest, 1200 m, 14.vi.2004, Ozkan 4038
S. cadmica Boiss	Ankara: Bala, Beynam national park, under forest, 1200 m, 14.vi.2004, Ozkan 4034
S. blepharochlaena Hedge & Hub.-Mor.	Kırşehir: Cicekdagı, Ahmet Veli Tumba, 1500 m, 28.v.2004, Ozkan 4024
S. multicaulis Vahl.	Erzincan, Aşkale Mountain, 1700m, 2017, Özdemir
S. cryptantha Montbret & Aucher ex Bentham	Kırşehir: Cicekdagı, rock hills, 1150 m, 06.vi.2005, Ozkan 5020
S. microstegia Boıss. & Bal.	Sivas: Suşehri entrance, roadside, 1400 m, 01.viii.2004, Ozkan 4084

3. Results and Discussion

Studies have demonstrated that plants endowed with trichomes exhibit a reduced propensity to be consumed by herbivores or subjected to attack by parasitic organisms. This phenomenon has been observed in individuals of the same species that exhibit polymorphisms in trichome production (Navarro and Oualidi, 1999). Elimination of volatile elements has been demonstrated to be a strategy employed by plants to attract pollinators. This process is exemplified by the presence of trichomes on the sepals, petals, and even ovaries of certain species (Giuliani et al., 2018).

Capitate glandular hairs typically comprise a stalk and a head cell. They are categorised into three types according to their secretion method. It was determined that certain capitate hairs had a round head and cuticular droplets, indicating a Type I classification. Conversely, other capitate hairs had a vertically elongated head cell, suggesting a Type II classification. Some of these hairs were found to have a cup-like head cell and were categorised as Type III. As the head cell wall collapses downwards, the cuticle expands to form a goblet-shaped glandular hair. Once secretion has finished, the head resembles a volcano crater. Peltate glandular hairs consist of a wide, short stalk cell and a large,

rounded head cell. These cells are arranged in one or two whorls. In these hairs, secretion accumulates beneath the cuticle and is released when the cuticle is mechanically disrupted (Baran, 2005).

The subsequent investigation focused on the glandular hair types of the species, as illustrated in Tables 2-6. Capitate and peltate hairs of various types were observed on the stem, leaf, petiole, bract, calyx and corolla of the *Salvia* species under study. Capitate hairs were characterised by a head consisting of one to three cells, a stalk comprising zero to eight cells, and a base measuring one to four cells. Peltate hairs were found to have a base comprising one to six central cells and four to ten peripheral cells (Figures 1-7). In *S. wiedemannii*, capitate hairs of types 1, 2, and 3 were observed. The corolla is distinguished by a greater variety of hairs in comparison to other parts of the plant. Capitate hairs were observed to possess between one and two heads, between zero and five necks, and between one and three basal cells (Table 2). In *S. microstegia*, capitate hairs of types 1, 2, and 3 with 1-2 heads, 0-5 necks, and 1-3 basal cells were also observed (Table 2). In *S. tchihatcheffii*, only capitate hairs of types 1 and 2 were found, while the cup-shaped capitate hair type 3 was not observed. These hairs are characterised by the presence of 1-2 heads, 0-3 necks, and 1-2 basal cells (Table 2). In *S. cadmica*, the variety of hairs is quite high. Capitate hairs of type 3 are present on the leaves and petiole, but not on other parts of the plant. The presence of glandular capitate hairs with 1 head, 1-7 neck, and 1-4 basal cells was observed (Table 3). *S. blepharacteana* also exhibits high hair diversity, similar to S. cadmica, with 1-2 head hairs, 1-8 neck hairs, and 1-4 basal celled capitate hairs (Table 4). In *S. cryptantha*, only type 1 capitate hairs with 1-2 head, 1-3 neck, and 1-2 basal cells were found. In S. multicaulis, type 1 and 2 hairs with 1 head, 1-4 neck, and 1-3 basal cells were observed, while type 3 cup-shaped hairs were not found (Table 5). In *S. suffiructosa,* type 1 hairs were not observed. Type 2 and 3 capitate hairs with 1 head, 1-3 neck, and 1-2 basal cells were detected (Table 5). The present study found that *S. blepharacteana* and *S. cadmica* exhibited the greatest number and diversity of hairs. *S. cryptantha, S. tchihatcheffii* and *S. suffiructosa* had the fewest and least diverse hairs. The following tables provide a detailed overview of the morphological structure, cell numbers, and distribution of glandular hairs on the aerial organs of eight *Salvia* species (Table 2-6).

Numerous research studies have been conducted on glandular hairs that produce essential oils, which are a defining feature of the Lamiaceae family. The hair structures of these plants have been studied in detail by Kesercioğlu and Nakiboğlu (1992), Yuliani and Ratnawati (2018), Agustin et al. (2022), Kaya (2024), Nishizawa et al. (1992), Ascensao and Pais (1998), Kolalite (1998), Bisio et al. (1999), Bottega and Corsi (2000), Turner et al. (2000) and Özdemir (2004, 2005a and 2005b). These studies have shown that peltate hairs in certain *Salvia* species usually have four central cells and seven to twelve peripheral cells, although occasionally they have two central cells. Capitate hairs consist of one or two head cells and one to five stalk cells. The results of the present study show that peltate hairs in *Salvia* species have between one and six central cells and between four and ten peripheral cells. Capitate hairs are characterised by a head comprising one to three cells, a stalk comprising one to eight cells and a base comprising one to four cells. Peltate hairs represent a prevalent glandular hair type within the Lamiaceae family. In a 2024 study by Hussin et al. (2024) on members of the Lamiaceae family, peltate hairs were observed in 11 species and only capitate hairs in 1 species. In the present study, peltate hairs were observed in six *Salvia* species. As demonstrated in Table 6, the central and peripheral cell numbers are presented in detail. In a specimen of the species *Phlomis bruguieri* Desf., which belongs to the Lamiaceae family, capitate glandular hairs with 1-2 head cells and 1-3 neck cells were observed on the stem, petiole, and midrib (Ahmed et al., 2025). In all the species we studied, there was greater diversity in the head and neck cells, and this was also observed in the capitate hairs of *P. bruguieri.*

Table 2. Capitate Glandular Hairs of the *Salvia* Species

		TYPE I			TYPE II			TYPE III	
	Head	**Stalk**	**Base**	**Head**	**Stalk**	**Base**	**Head**	**Stalk**	**Base**
S. wiedemannii									
Stem	1	1	1	1	1	1	1	1	1
	1	2	1						
	2	2	1						
Leaf	1	0	1	1	1	1			
	1	1	1	1	2	1			
				2	2	1			
Petiole	1	1	1						
Corolla	1	0	1	1	1	1	1	2	1
	1	1	1	1	2	1	1	3	1
	1	2	1	1	3	2	1	3	2
	1	2	2				1	3	3
	1	3	2				1	4	1
	1	4	2				1	4	2
							1	4	3
							1	5	2
S. microstegia									
Stem	1	0	1	1	1	1	1	3	1
	1	2	1	1	2	1	1	3	2
	1	3	1	1	2	2	1	4	1
				1	3	1			
Leaf	1	2	1	1	2	1	1	3	1
	1	3	1	1	3	1			
	1	3	2	1	4	2			
	1	4	1						
Bract	1	2	2	1	2	1			
	1	3	2	1	4	3			
	1	4	2	1	5	3			
	1	4	3						
Calix	1	2	1	1	2	1			
	1	2	2						
	1	3	1						
	1	3	2						
	1	4	2						
S. tchihatcheffii									
Stem	1	0	1	1	0	1			
	1	1	1	1	1	1			
	2	1	1	1	2	1			
				1	2	2			
				1	3	2			
				2	0	1			
				2	1	2			
Leaf	1	2	1	1	1	1			
				1	2	1			
				1	3	1			
				1	3	2			
Calix	1	2	1	1	0	1			
				1	2	1			

Bottega and Corsi (2000) reported one to two head cells in capitate trichomes. In this study, *S. cadmica* exhibits up to three head cells (Table 3, Figure 3). In the study conducted by Kaya (2011), capitate hairs with 1-2 neck cells and a head cell, a short stalk with one basal cell and (two) peltate hairs consisting of four to eight secretory cells were reported in the species *S. wiedemannii*. In the present study, capitate hairs with 0-5 neck cells and 1-2 head cells, as well as peltate glandular hairs with 4-10 secretory cells, were observed in the species *S. wiedemannii* (Figure1, Table 2 and 6).

Table 3. Capitate Glandular Hairs of the *Salvia* Species

		TYPE I			TYPE II			TYPE III	
	Head	**Stalk**	**Base**	**Head**	**Stalk**	**Base**	**Head**	**Stalk**	**Base**
S. cadmica									
Stem	1	2	1	1	1	1			
	1	1	1	1	2	1			
	1	5	1	1	2	2			
	2	2	2	1	3	2			
	3	1	1	1	4	2			
	3	2	2	1	4	3			
				1	5	3			
				1	7	4			
				2	2	1			
				2	2	2			
				3	2	1			
Leaf	1	3	2	1	2	2	1	3	2
	1	3	3	1	3	2	1	4	2
				1	3	3	1	4	3
				1	4	2	1	6	2
				1	5	3	1	6	3
				2	2	2			
Petiole	1	1	1	1	2	3	1	2	2
				1	3	2	1	3	2
				1	3	2	1	3	3
				1	4	2	1	4	2
				1	4	3			
				1	5	2			
Calix				1	1	1			
				1	4	3			
				1	5	2			
				1	6	3			
Corolla				1	4	1			
				1	4	2			
				1	5	1			
				1	5	2			
				1	6	1			
				1	6	2			
Bract	1	1	2	1	3	1			
	1	2	2	1	5	3			
				1	5	4			

In a 2023 study by Jažo et al. (2023) on the species *S. officinalis* L. 1 to many celled neck, and 1-2 head-celled capitate hairs, 8-12 head-celled peltate hairs were observed. These feather types were also observed in the present study. A bicellular head has been observed in capitate hairs on *S. blepharacteana, S. cadmica, S. wiedemannii, S. cryptantha, S. tchihatcheffii* and *S. suffiructosa*. The tricellular head is present only capitate hairs of *S. cadmica*. Seated glandular hairs have been observed in *S. wiedemannii, S. migrostagia* and *S. tchihatcheffii.* Peltate hairs have been documented in the S. *microstegia , S. wiedemannii, S. suffruticosa, S. cadmica, S. multicaulis* and *S. cryptantha* taxa. Compared to other species, *S. wiedemannii* and *S. cryptantha* exhibit denser peltate hairs. Although scanning electron microscopy (SEM) and histochemical analyses could not be performed, our findings suggest that glandular hair characteristics could be used as a taxonomic criterion.

Table 4. Capitate Glandular Hairs of the *Salvia* Species

S. blephoracteana									
		TYPE I			**TYPE II**			**TYPE III**	
	Head	**Stalk**	**Base**	**Head**	**Stalk**	**Base**	**Head**	**Stalk**	**Base**
Stem	1	2	2	1	5	3	1	3	2
				1	3	2	1	4	2
				1	2	2	1	2	1
				1	2	1	1	2	2
				1	4	2	1	4	2
				1	6	2	1	3	3
				2	2	3	1	5	2
				1	2	3			
Leaf	1	3	1	1	3	2	1	4	2
				1	1	1	1	3	2
				1	5	2	1	5	3
				1	3	3	1	4	4
				1	3	1	1	4	3
				2	1	1			
Petiole				1	3	2	1	4	2
				1	6	3	1	3	2
				1	5	3	1	5	3
Calix	1	2	1	1	2	1	1	4	2
	1	2	2	1	4	2	1	5	3
				1	2	2	1	2	1
				1	5	2			
Corolla	1	2	1	1	2	1	1	3	1
				1	3	2	1	2	1
				1	4	2	1	5	3
				1	5	2	1	2	3
Bract	1	2	2	1	8	2	1	3	2
	1	3	2	1	4	2	1	4	2
	1	5	2	1	2	2	1	5	2
	1	2	3	1	4	3	1	3	1

Table 5. Capitate Glandular Hairs of the *Salvia* Species

		TYPE I			**TYPE II**			**TYPE III**	
	Head	**Stalk**	**Base**	**Head**	**Stalk**	**Base**	**Head**	**Stalk**	**Base**
S. cryptantha									
Stem	1	1	1						
	1	2	1						
	2	1	1						
Leaf	1	1	1						
Calix	1	1	1						
	1	2	1						
	1	2	2						
	1	3	2						
	2	1	1						
S. multicaulis									
Stem	1	1	1	1	2	1			
	1	2	1	1	4	3			
	1	3	2						
Leaf	1	2	1						
	1	3	1						
Bract	1	3	1						
	1	4	2						
Calix	1	2	1	1	2	1			
	1	2	2	1	3	3			
	1	2	3	1	4	2			

	1	3	2						
	1	4	2						
S. suffiructosa									
Stem				1	1	1			
Leaf							1	2	2
							1	3	2

Table 6. Peltate Glandular Hairs of the *Salvia* Species

	Centre Cell	**Periphery Cell**
	S. microstegia	
Bract	3	6
	S. wiedemannii	
Leaf	2	6
	1	4
Bract	4	8
Calix	2	4
Corolla	2	4
	3	6
	4	8
	6	10
	S. suffiructosa	
Calix	2	4
	2	6
	4	8
	S. cadmica	
Leaf	2	4
	3	6
	4	10
	S. multicaulis	
Leaf	2	6
	S. cryptantha	
Stem	2	4
	4	8
Leaf	2	6
	4	8
Calix	4	4
	4	6
	3	8

Figure 1. Glandular hairs of *S. wiedemannii* species, hc: head cell, sc: stalk cell; Capitate Hairs: A-I: Type I, J-M: Type II, N-V: Type III; Peltate Hairs: W-Z

Figure 2. Glandular hairs of *S. tchihatcheffii* species (A-O), and *S. suffruticosa* species (P-V), hc: head cell, sc: stalk cell;
Capitate Hairs: A-F, P-R: Type I, G: Type II, H-K, R-T: Type III; Peltate Hairs: L-O, U

Figure 3. Glandular hairs of *S. cadmica* species, hc: head cell, sc: stalk cell; Capitate Hairs: A-I: Type I; J-Z: Type II; 1-13: Type III; Peltate Hairs: 14-16

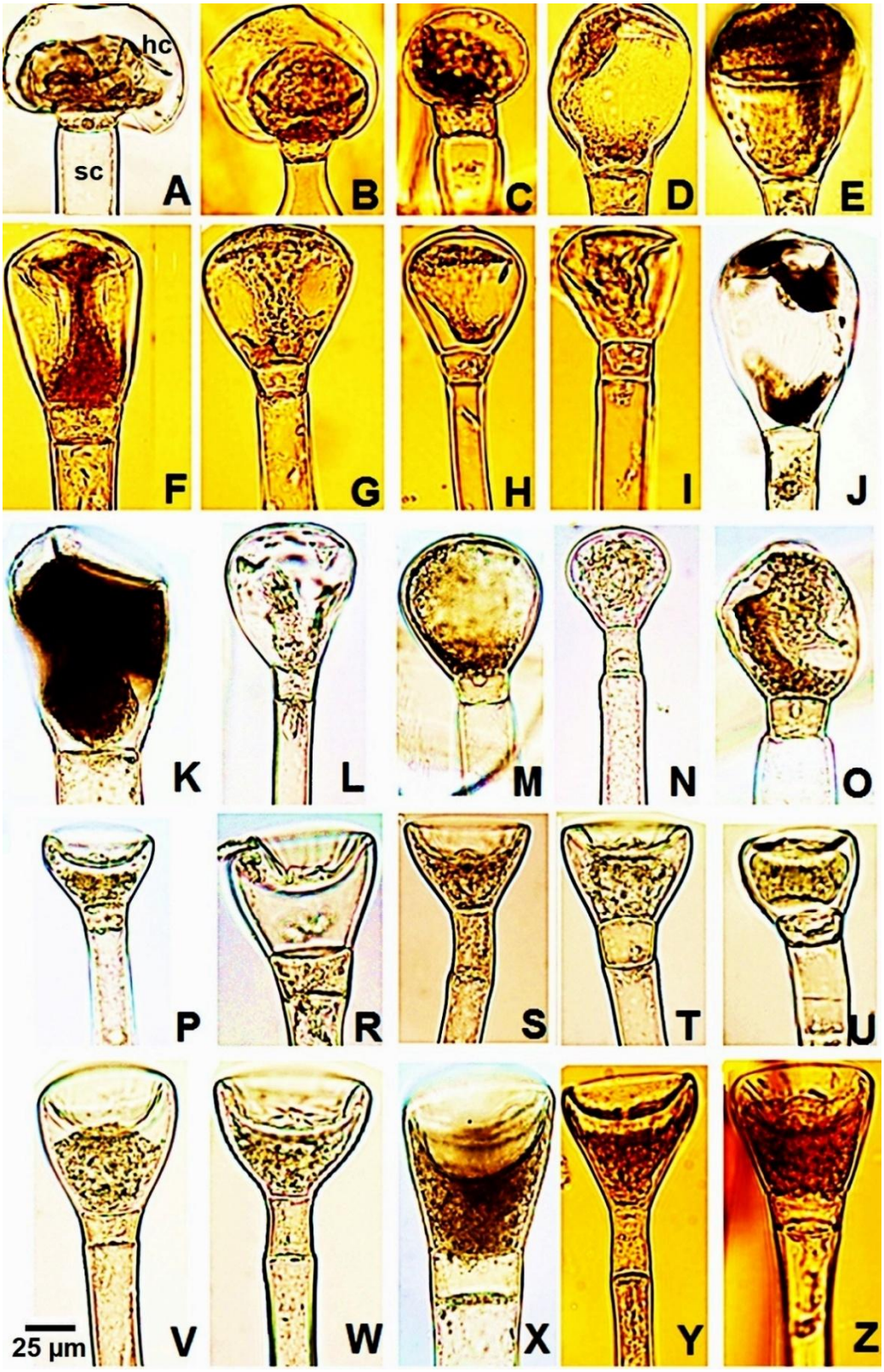

Figure 4. Glandular hairs of *S. blepharochlaena* species, hc: head cell, sc: stalk cell; Capitate Hairs: A-C: Type I, D-O: Type II, P-Z: Type III

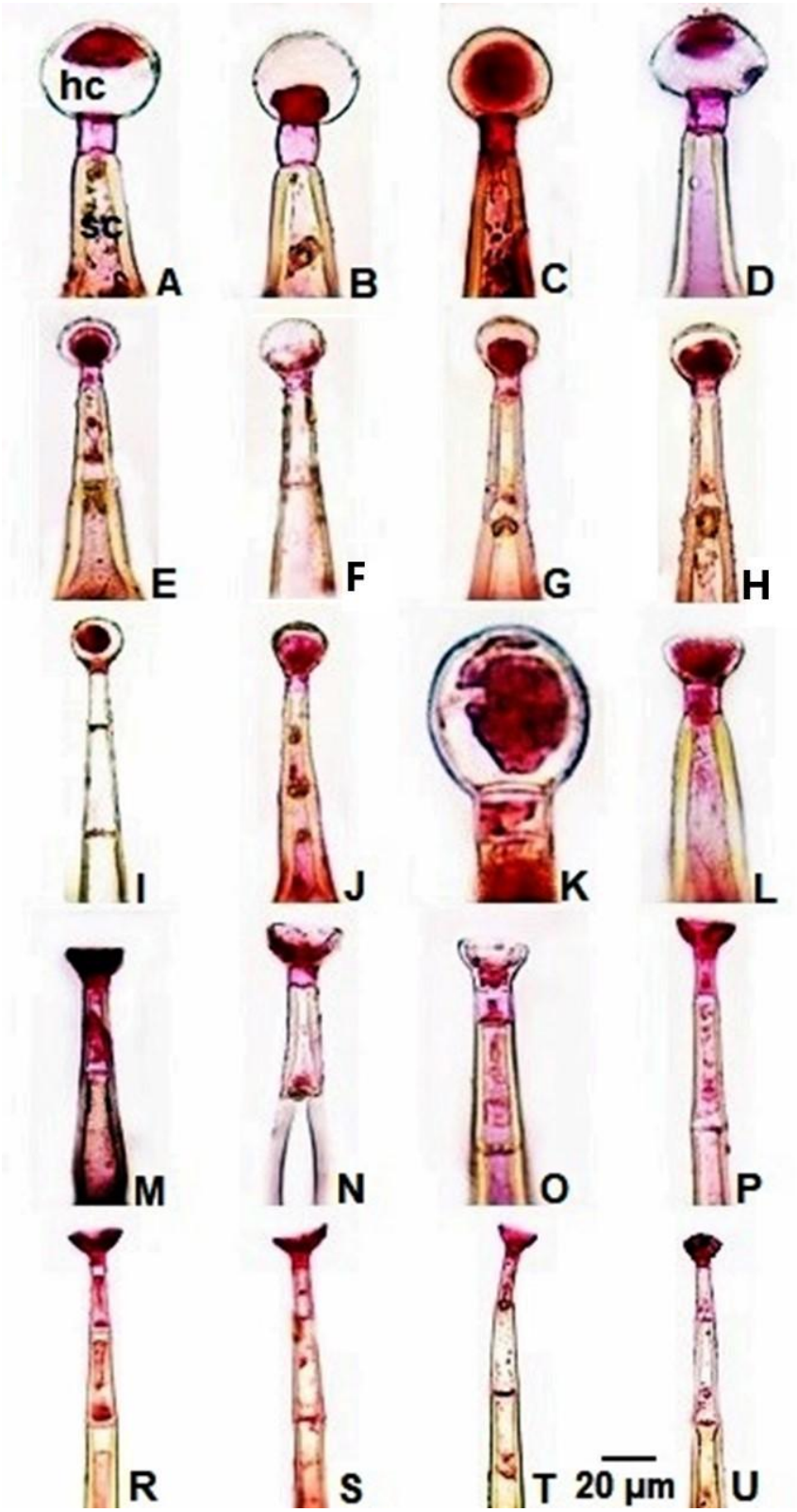

Figure 5. Glandular hairs of *S. multicaulis* species, hc: head cell; sc: stalk cell; Capitate Hairs: A-F: Type I, G-K: Type II, L-U: Type III

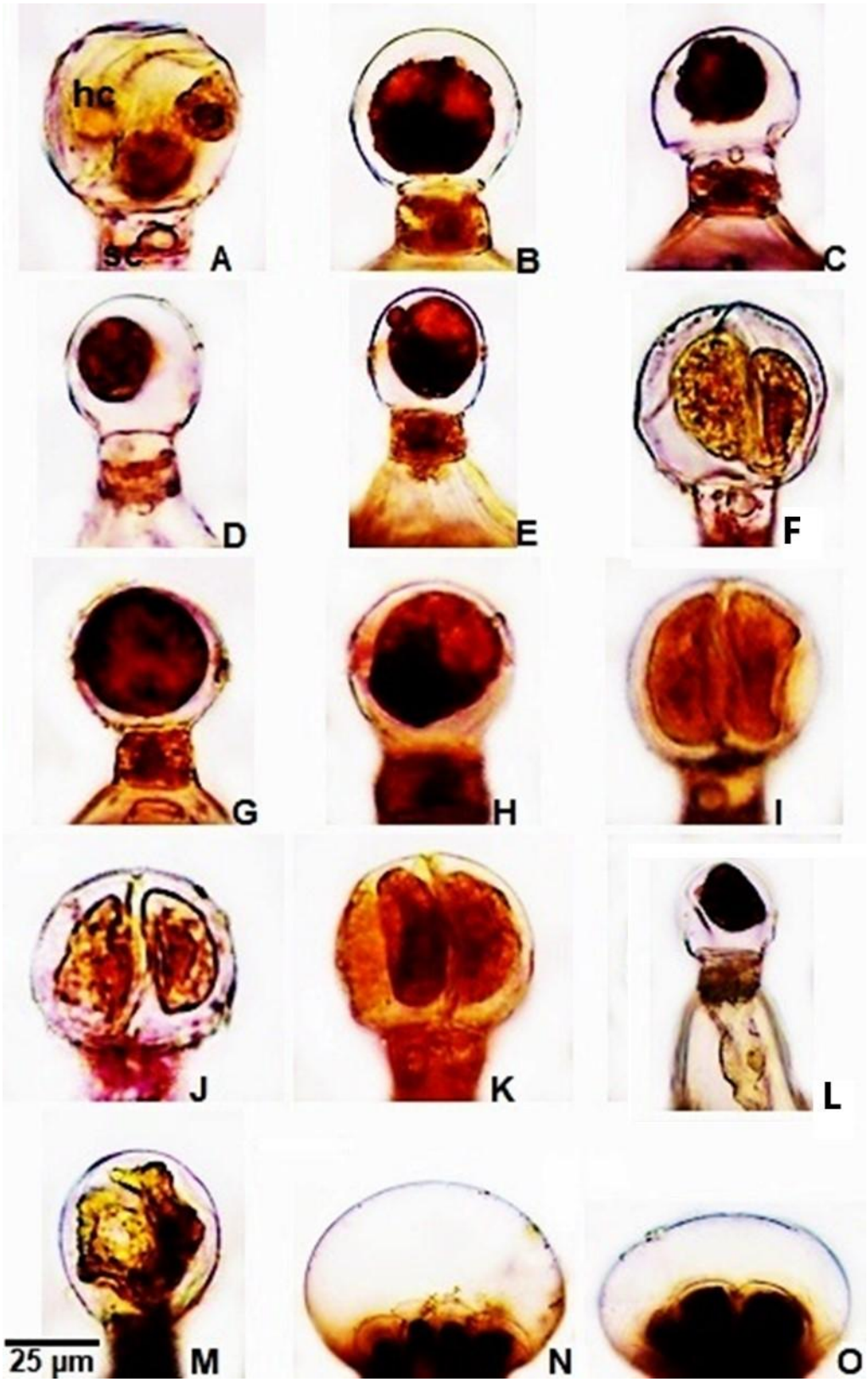

Figure 6. Glandular hairs of *S. cryptantha* species, hc: head cell; sc: stalk cell; Capitate Hairs: A-K: Type I, L-M: Type II, Peltate Hairs: N-O

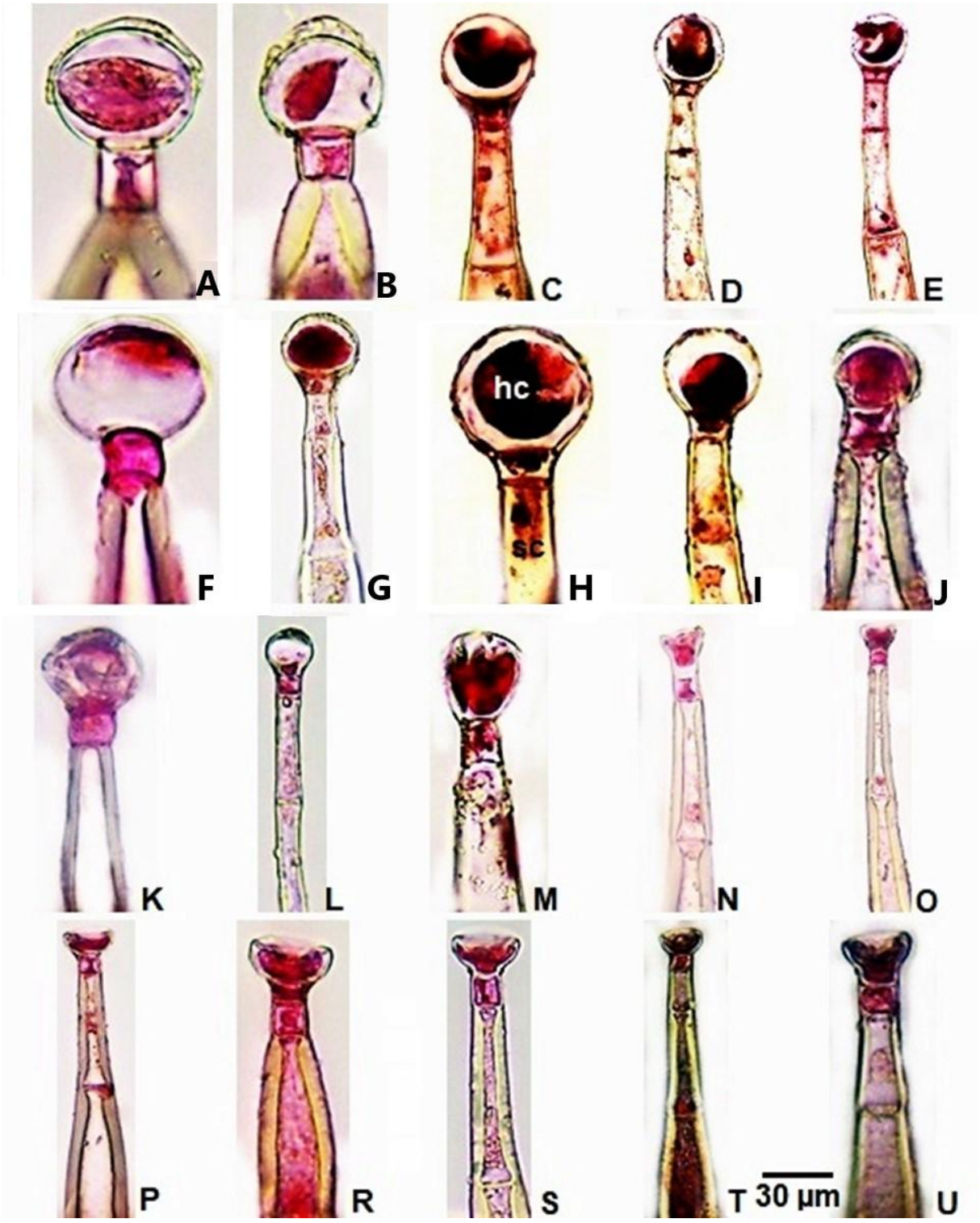

Figure 7. Glandular hairs of *S. microstegia* species, hc: head cell, sc: stalk cell. Capitate Hairs: A-G: Type I, H-M: Type II, N-U: Type III

4. Conclusion

The present study was conducted with the objective of ascertaining the distribution and diversity of glandular hairs in eight different *Salvia* species. The above-ground parts of the species, including stems, leaves, petioles, bracts, calyxes, and corollas, were examined in detail and presented in tables and figures. Although the variety and density of these structures differed among the species, capitate glandular hairs were predominantly observed in most of the studied species. Peltate hairs, which are prevalent among members of the Lamiaceae family, were also identified. It is hoped that the findings

will provide a foundation for future studies on glandular hairs in *Salvia* species and assist in intragenus classification.

Acknowledgements

We would like to thank Prof. Dr. Mustafa Özkan for providing the studied samples.

Conflict of Interest Statement

There is no conflict of interest between the authors.

References

Ahmed, I.H., Darwish, K. & Wahid, C.F. (2025). Morphological and Anatomical Study of *Phlomis bruguieri* (Lamiaceae), in the Iraqi Kurdistan Region, *Passer Journal of Basic and Applied Sciences, Passer*, 7(1), 192-203.

Ascensao, L. & Pais, M.S. (1998). The Leaf Capitate Trichomes of *Leonotis leonurus*: Histochemistry, Ultrastructure and Secretion. *Annals of Botany*, 81(2), 263-271.

Baran, P. (2005). *Salvia argentea* L.ve *Salvia viridis* L. (Lamiaceae) türleri üzerinde morfolojik ve anatomik bir araştırma, Yüksek Lisans Tezi, Celal Bayar Üniversitesi, Manisa, Türkiye.

Bisio, A., Corallo, A., Gastaldo, P., Romussi, G., Ciarallo, G., Fontana, N., De Tommasi, N. & Profumo, P. (1999). Glandular Hairs and Secreted Material in *Salvia blepharophylla* Brandegee ex Epling Grown in Italy. *Annals of Botany*, 83(4), 441-452.

Bottega, S. & Corsi, G. (2000). Structure, Secretion and Possible Functions of Calyx Glandular Hairs of *Rosmarinus officinalis* L. (Labiatae). *Botanical Journal of The Linnean Society*, 132(4), 325-335.

Cantino, P.D. (1990). The phylogenetic significance of stomata and trichomes in the Labiatae and Verbenaceae. *J. Arnold Arbor*. 71, 323-370.

Agustin, Y.T.A., Ermayanti, E. & Susanti, R. (2022). Leaf Trichomes Identification in Lamiaceae Family Plants And Contribution To High School Biology Learning. *JPBIO*, 7(1), 19-35.

Giuliani, C., Ascrizzi, R., Lupi, D., Tassera, G., Santagostini, L., Giovanetti, M., Flamini, G. & Fico, G. (2018). *Salvia verticillata:* Linking glandular trichomes, volatiles and pollinators. *Phytochemistry,* 155, 53-60.

Hussin, H., Noor, N.N.M. & Mohamed, F. (2024). Taxonomic Significance of Trichome Ultrastructure in Five Genera of Lamiaceae. *Journal of Science and Mathematics Letters*, 12(1), 8-17.

Jažo, Z., Glumac, M., Paštar, V., Bekti´, S., Radan, M. & Carev,I. (2023). Chemical Composition and Biological Activity of *Salvia officinalis* L. Essential Oil, *Plants*, 12, 1794.

Kaya, A. (2011). Morphologıcal, Anatomıcal and Trıchomes Propertıes of *Salvıa wıedemannii* Boıss. Endemıc to Turkey. *Turkish Journal of Pharmaceutical Sciences,* 8(3), 227-238.

Kaya, A. (2024). Lamıaceae Familyasının Tüy Morfolojisi. *Journal of Faculty of Pharmacy of Ankara University,* 48(3), 1219-1235.

Kesercioğlu, T. & Nakiboğlu, M. (1992). Investigations on Some *Salvia* L. Species Collected from Turkey. *Recent Advances in Medicinal. Aromatic and Spice Crops*, 2, 325-344.
Kolalite, M.R. (1998). Comparative Analysis of Ultrastructure of Glandular Trichomes in Two *Nepeta cataria* Chemotypes (*N. cataria* and *N. cataria* var. *citriodora*). *Nordic Journal of Botany*, 18(5), 589-598.

Mraz, P. (1998). The Structure and Development of The Glabrous Trichomes of *Teucrium montanum* (Lamiaceae). *Biologia Bratislava,* 53(1), 65-72.

Metcalfe, J.R. & Chalk, L. (1972). Anatomy of the Dicotyledons. 2 Vols. Oxford, Clarendon Press. Oxford.

Navarro, T. & El Oualidi, J. (1999) Trichome morphology in *Teucrium* L. (Labiatae). A taxonomic review. *Anales Del Jardín Botánico De Madrid*, 57, 277-297.

Navarro, T. & El Oualidi, J. (2000). Trichome morphology in *Teucrium* L. (*Labiatae*). A taxonomic review. *Anales Del Jardín Botánico De Madrid,* 57(2), 277-297.

Nishizawa, A., Honda, G., Kobayashi, Y. & Tabata, M. (1992). Genetic control of peltate Glandular Trichome Formation in *Perilla frutescens*, *Planta Medica*, 58(2), 188-191.

Özdemir, C. (2004). Comparison of Glandular and Eglandular hairs in some species of *Labiatae* collected from Turkey. *Journal of Economic and Taxonomic Botany*, 28(3), 2004.

Özdemir, C. & Altan, Y. (2005a). Morphological and Anatomical Investigations on Endemic *Scutellaria orientalis* L. subsp. bicolour (Hochst.) Edmund and subsp. santolinoides (Hausskn ex Bornm). *Pakistan Journal of Botany*, 37(2).

Özdemir, C. & Altan, Y. (2005b). External and Internal Morphological Characteristics of Endemic *Salvia huberi* Hedge (*Lamiaceae). Bangladesh Journal of Botany*, 2005.

Turner, G.W., Gershenzon, J. & Croteau, B. (2000). Distribution of Peltate Glandular Trichomes on Developing Leaves of *Peppermint*. *Plant Physiology*, 124(2), 655-663.

Yuliani, E., & Ratnawati. (2018). Study of structure diversity and density of glandular trichomes in several medicinal plants. *Jurnal Prodi Biologi*, 7(5), 262-268.