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Morphological characteristics of some *Salvia* L. taxa in Sakarya Province (Turkey)

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Abstract
In this study, morphological characteristics of five *Salvia* L. taxa (*S. verticillata* L. subsp. *amasiaca* (Freyn & Bornm.) Bornm., *S. tomentosa* Mill., *S. virgata* Jacq., *S. forskahlei* L. and *S. sclarea* L.) collected from Geyve, Taraklı, Akyazı and Sapanca districts of Sakarya Province were studied comparatively. Root, stem, leaf, flower and seed characteristics were determined and detailed morphological measurements were made on these organs. It was observed that the morphological findings were highly consistent with the previous studies, but some deviations were observed at the minimum and maximum limits of the measurement values.

Keywords: *Salvia*, morphology, Sakarya, Turkey.

Özet
Bu çalışmada Sakarya ili Geyve, Taraklı, Akyazı ve Sapanca ilçelerinden toplanan beş *Salvia* L. taksonunun (*S. verticillata* L. subsp. *amasiaca* (Freyn & Bornm.) Bornm., *S. tomentosa* Mill., *S. virgata* Jacq., *S. forskahlei* L. ve *S. sclarea* L.) morfolojik özellikleri karşılaştırmalı olarak incelenmiştir. Bu taksonların; kök, gövde, yaprak, çiçek ve tohum özellikleri belirlenmiş ve bu organlar üzerinde detaylı morfolojik ölçümler yapılmıştır. Elde edilen morfolojik bulgular daha önce yapılan çalışmalarla karşılaştırıldığında, morfolojik karakterlerin benzerlik gösterdiği, fakat ölçüm değerlerinin minimum ve maksimum sınırlarında bazı sapmalar olduğu gözlenmiştir.

Anahtar kelimeler: *Salvia*, morfoloji, Sakarya, Türkiye.

INTRODUCTION

The *Salvia* L. genus known as ‘sage’ is one of the richest species of Lamiaceae family. Many wild sage species were used to treat various diseaes consciously or unconsciously since ancient times, this genus has been named *Salvia* derived from the word Salvere which means ‘to be healthy’ in Latin language (Baytop 1999). *Salvia* has 986 species in the world (www.theplantlist.org 2019). In Turkey, identified as 87 species in Flora of Turkey and were recorded as 50% of these are endemic (Davis 1982, Güner et all. 2000). According to the latest studies in our country, *Salvia* species number is 99 and total of 106 taxa are 58 endemic (Güner et all. 2012).

Sakarya and its environs, which we have chosen as the study area, are in A3 square in European-Syberia Phytogeographical Region according to grid system applied by Davis (Davis 1965).

Salvia, which is thought to have originated from Anatolia and Southern Europe, is widespread in Mediterranean countries. They are very resistant to cold and drought and show better development in calcareous and sandy soils (Baydar 2005). *Salvia* taxa in Turkey can live in a wide range of habitats, from sea level to about 3500 m, such as steppe, rocky areas, scrub, forest, meadows, bushes, dunes, roadside slopes, gypsiferous areas, serpentine areas and alpine zones (Karabacak 2009). *Salvia* is a valuable essential oil, spice and tea plant. It is used frequently in perfumery and pharmaceutical industry due to its essential oils. The composition of these essential oils include cineol, thujone, camphor and linalyl acetate (Baydar 2005). *Salvia* species are known with different names such as adacayi, salba, calba, dadirak and kizillik in Turkish (Baytop 1999). The infusion of stem or the essential oil of *Salvia* is used to treat colds, cough, gingivitis, toothache, sore throat, diabetes, high blood pressure, stomach and abdominal pain, rheumatism and skin diseases. It is also used as vasoconstrictor, expectorant and sedative (Skoula 1999).

S. tomentosa (large flowering sage) leaves are used as medical sage (Baytop 1999). Leafy branches are collected and exported to abroad after drying (Baydar 2005). *S. virgata* is known as friar's cowl or larus and its leaves are used topically as wound healing (Baytop 1999, Baytop 1963). *S. forskahlei* is known as chalba and fresh leaves were used to make stuffed meat (Baytop 1999). *S. sclarea* is known as bear ear, musk sage or woolly sage. Flowering branches contain tannin, resin, essential oil and bitter matter. Flowering branches or leaves are used as sedating and reducing perspiration, also used as a 5% infusion in the treatment of costiveness and stomach diseases (Baytop 1999, Baytop 1963). Moreover it is used as perfume raw material and has economic value (Baydar 2005).

Salvia species are usually composed of perennial, herbaceous, semi-shrubby or shrubby plants and leaves, calyx and hair on the flower are important characteristics used to distinguish species (Davis 1982). Also in the revision studies on *Salvia*; morphological features such as stamen type, verticillaster number, calyx shape, corolla shape, corolla length, length of the corolla tube, whether or not annulus or upper lip is flat or helmet shaped, are distinctive characters in the determination of species (Karabacak 2009 and Doğan et all. 2008).

MATERIALS AND METHODS

This study was carried out on *Salvia* populations collected from Geyve, Tarakli, Akyazi and Sapanca districts of Sakarya between the years of 2016-2017. Plant collection was conducted between May and September, the flowering periods of the *Salvia*. The collected plants were prepared as herbarium specimens and morphological features such as location, habitat, vegetation type, altitude, flower color and stem branching shape were recorded. The collected specimens are housed in the Herbarium of the Faculty of Forestry, Duzce University (DUOF). Davis's Flora of Turkey is used in the determination of species (Davis 1982). General morphological measurements were made in 10 plants taken for each taxon and visible morphological characters were recorded. The flower morphology was made on a total of 50 flowers, 5 flowers on each plant. Plant height (cm) was measured from the bottom (under the ground part) to the top of the plant. Stem thickness (cm), measured as a diameter of the main stem 10 cm above the soil surface. The verticillasters on the main stem and side branches were counted seperately and averaged. Leaf measurements (cm), the largest and the smallest leaves on the plant were measured and averaged. Calyx tooth length (cm), the length of the longest teeth were measured. The analysis of the measured values was made in Microsoft Excel.

RESULTS

Salvia verticillata L. subsp. *amasiaca* (Freyn & Bornm.) Bornm.

Plant 56-76.5 cm, perennial, semi bushy, dense secretion and cover hairy (Table 2,3). **Root** 6.5-16 cm, main root is long taproot, side roots available. **Stem** 45-62.5 x 0.3-0.4 cm, upright or elevated, four cornered, usually multiple and branched above (Table 1). **Leaves** 2.5-8.2 x 0.9-5.4 cm, simple, oblong, elliptic or ovate-oblong or unequal lobular lyrate, acute on the top, acuminate, round or semi-cordate on the base, edges are serrate, leaf surface cover and gland hairy. **Petiole** between 0.3-6 cm. **Inflorosens** paniculate, **Verticillasters** 2-46 flowered, 1-7 on a branch, 0.6-4.7 cm very distinctly spaced. **Pedicel** 0.3-0.6 cm. **Calyx** 0.45-0.65 cm, tubular, dark violet-purple color, longer and thicker in the fruit, outher cover hairy, two-lipped, upper lip is shorter than the lower lip and three teeth, lower lip has two teeth, **Calyx teeth** 0.05-0.15 cm, longer on the fruit. **Corolla** 0.8-1.2 cm, light purple, purple, lilac colored, two-lipped, flat on the upper lip and narrows at the base, lower lip is 3 lobed, corolla tube is flat, annulus available, **Labellum width** 0.2-0.35 cm. **Pistil** 0.8-1.2 cm, **Stamens** C type, lower theca reduced, subulate, **Filaments** 0.15-0.4 cm, **Anther** 0.1-0.15 cm. **Bracts** 0.8-5 x 0.35-2.7 cm, ovate-acuminate. **Bracteoles** 0.4-0.9 x 0.2-0.4 cm. **Seeds** 0.15 x 0.1 cm, oval, dark brown or black.

Table 1. Comparison of morphological characteristics on *Salvia* species.

		S. verticillata* subsp. *amasiaca	***S. tomentosa***	***S. virgate***	***S. forskahlei***	***S. sclarea***
STEM	**Stem type**	Upright or elevated	Upright or elevated	Upright	Upright	Upright
	Leaf type	Simple or lyrate	Simple	Simple	Simple or lyrate	Simple
	Leaf shapes	Oblong, elliptic or ovate-oblong	Oblong, elliptic, ovate	Ovate, wider ovate	Elliptic, ovate, wider ovate, sometimes cordate	wider ovate, cordate
LEAF	**Leaf tip**	Acute, acuminate	Acuminate, acute	Acute	Acute, obtuse	Acute, acuminate, obtuse
	Leaf side	Serrate	Crenate, dentate	Irregular lobed erose-crenate	Crenate, undulate	Crenate-erose, dentate, mostly irregular lobed
	Leaf base	Round or semi-cordate	Rotundate, rotundate-truncate	Rotundate or cordate	Rotundate or cordate	Rotundate, cordate, cordate-truncate
BRACT	**Bract color**	Green	Green	Green	Green	White, pink or light purple
	Bract type	Ovate-acuminate	Ovate or wider ovate	Ovate-acuminate	Ovate or wider ovate	Ovate-acuminate
CALYX	**Calyx color**	Dark violet-purple	Green-dark violet	Greenish lilac	Green or lower part greenish, upward violet	Green
	Calyx type	Tubular	Tubular	Tubular - campanulate	Ovate- campanulate	Ovate- campanulate
COROLLA	**Corolla color**	Light purple, purple, lilac	Lilac, purple or pinkish	Lilac-purple, rarely white	Violet-purple, lilac	White or lilac-purple
	Upper lip	Flat and narrows at the base	Flat	Falcate	Falcate	Falcate
	Corolla tube	Flat	Flat	Ventricose	Curved upward	Ventricose
STAMEN	**Stamen type**	C type	A type	B type	B type	B type
	Seed shape	Oval	Oval, triangular	Oval	Oval, triangular	Oval, triangular
SEED	**Seed color**	Dark brown or black	Dark brown or black	Dark brown or black	Dark brown or black	Dark brown

Flowering period: June- August; **Habitat:** Sub-forest, meadow, roadside, lake surroundings; **Altitude**: 448 m; **Location:** Sakarya Taraklı Taraklı-Gölpazarı road Hacıaliler village road turnout, 200 m Taraklı Kayaboğazı pond; **Date of collection:** 18/VI/2016; **Herbarium number:** DUOF 8785. The general view of the taxa is given below (Image 1).



Image 1. General view of *Salvia verticillata* subsp. *Amasiaca*.

Table 2. Comparison of morphological measurements on *Salvia* species

	Characteristics Min. - Max. (cm)	***S. verticillata* subsp. *amasiaca***	***S. tomentosa***	***S. virgata***	***S. forskahlei***	***S. sclarea***
PLANT	Plant length	56-76.5	55-90	32.5-91.5	36-93	85-135
ROOT	Root length	6.5-16	12-27	3-24.5	9-25	24-37.5
STEM	Stem length	45-62.5	41-82	26-78.8	21-85	53.5-104
	Stem width	0.3-0.4	0.2-0.5	0.2-0.5	1.5-3.5	0.5-1
LEAF	Number of leaves	7-12	5-9	5-9	4-11	4-10
	Length of basal leaf	_	_	4.8-13.5	6.2-24.3	_
	Width of basal leaf	_	_	2.1-8.7	3.7-16	_
	Leaf length	2.5-8.2	4.6-11.5	2.4-11.5	2-21.6	5.5-18.2
	Leaf width	0.9-5.4	1.5-4.6	1.1-6	1.1-9.1	3.6-13.5
PETIOLE	Length of basal petiole	_	_	1.3-8.5	4-18.5	_
	Petiole length	0.3-6	0.5-4.3	0.2-5	0.5-7.6	0.9-17
INFLORESCENCE	Number of verticillasters	1-7	2-7	4-20	3-16	3-10
	Internodes length	0.6-4.7	0.7-4.8	0.2-3.4	1.1-4.6	0.5-3.6
	Flower number in a verticillaster	2-46	1-12	3-7	1-10	1-6
FLOWER	Calyx length	0.45-0.65	1.1-1.5	0.5-0.85	0.65-1.1	0.8-1.3
	Length of calyx teeth	0.05-0.15	0.25-0.6	0.15-0.3	0.2-0.4	0.35-0.6
	Pedicel length	0.3-0.6	0.15-0.7	0.1-0.2	0.2-0.6	0.2-0.5
	Corolla length	0.8-1.2	2.2-4	1.2-1.8	1.8-3	1.7-2.4
	Pistil length	0.8-1.2	2.1-3.6	1.2-1.85	2.3-3.3	2.3-3.6
	Filament length	0.15-0.4	0.3-0.55	0.5-0.7	0.6-1.3	0.7-1.8
	Anther length	0.1-0.15	0.2-0.35	0.15-0.25	0.2-0.4	0.2-0.35
	Labellum width	0.2-0.35	0.45-1.2	0.45-0.8	_	0.8-1.3
BRACT	Bract length	0.8-5	1.1-5.8	0.4-5.9	0.4-2.25	1.1-6.3
	Bract width	0.35-2.7	0.7-2.6	0.2-2.9	0.25-1.5	0.9-5.3
BRACTEOLE	Bracteole length	0.4-0.9	0.4-1	0.4-0.9	0.3-0.8	_
	Bracteole width	0.2-0.4	0.3-0.6	0.25-0.55	0.3-0.5	_
SEED	Seed length	0.15	0.2-0.3	0.15-0.2	0.15-0.2	0.25-0.3
	Seed width	0.1	0.15-0.25	0.1-0.15	0.1-0.15	0.2-0.25

Table 3. Comparison of morphological measurements of *Salvia verticillata* subsp. *amasiaca* with previous studies.

	Characteristics Min. - Max. (cm)	Our results	Flora of Turkey (1982) results	Doğan et all. (2008) results	Karabacak (2009) results
PLANT	Plant length	56-76.5	*	*	*
ROOT	Root length	6.5-16	*	*	*
STEM	Stem length	45-62.5	15-50	15-50	15-50
	Stem width	0.3-0.4	*	*	*
LEAF	Number of leaves	7-12	*	*	*
	Leaf length	2.5-8.2	2.5-13	2.5-15	2.5-15
	Leaf width	0.9-5.4	2-9	2-9	2-9
	Petiole length	0.3-6	1.5-7	1.5-10	1.5-10
INFLORESCENCE	Number of verticillasters	1-7	*	*	*
	Internodes length	0.6-4.7	*	*	*
	Flower number in a verticillaster	2-46	20-40	8-40	8-40
FLOWER	Calyx length	0.45-0.65	0.5-0.7	0.5-0.7	0.5-0.7
	Length of calyx teeth	0.05-0.15	*	*	*
	Pedicel length	0.3-0.6	0.2-0.8	0.2-0.7	0.2-0.7
	Corolla length	0.8-1.2	1.2	1.2	0.8
	Pistil length	0.8-1.2	*	*	*
	Filament length	0.15-0.4	*	*	*
	Anther length	0.1-0.15	*	*	*
	Labellum width	0.2-0.35	*	*	*
BRACT	Bract length	0.8-5	0.7	0.6	0.6
	Bract width	0.35-2.7	0.3	0.3	0.3
BRACTEOLE	Bracteole length	0.4-0.9	*	*	*
	Bracteole width	0.2-0.4	*	*	*
SEED	Seed length	0.15	0.22	0.22	0.22
	Seed width	0.1	0.13	0.13	0.13

* These data were not recorded in previous studies.

Salvia tomentosa **Mill.**

Plant 55-90 cm, perennial, semi bushy, dense secretion and cover hairy, clustered (Table 4). **Root** 12-27 cm, main root is long taproot, mostly integrated roots. **Stem** 41-82 x 0.2-0.5 cm, usually multiple, sometimes unique, upright or ascending, quadrangular, usually branched above. **Leaves** simple, 4.6-11.5 x 1.5-4.6 cm, Towards the top, dimensions and stems shrink, oblong, elliptic, ovate, below ones rotundate, rotundate-truncate, upper ones acuminate, acute, side ones sometimes irregular sometimes regular lobed crenate, dentate, leaf surface is covered with glandular and covering hair. **Petiole** between 0.5-4.3 cm. **Inflorosens** paniculate, **Verticillasters** 1-12 flowered, 2-7 on a branch, 0.7-4.8 cm spaced. **Pedicel** 0.15-0.7 cm. **Calyx** 1.1-1.5 cm, green-dark violet colored, tubular, longer in the fruit and pellicular, outher surface covered with glandular and covering hair, two-lipped, lips are equal sized, iki dudaklı, upper lip has three teeth, middle tooth is shorter than others, lower lip has two teeth. **Calyx teeth** 0.25-0.6 cm, longer on the fruit. **Corolla** 2.2-4 cm, lilac, purple or pinkish, two-lipped, upper lip is flat and two-lobed, lower lip is three-lobed and middle lobe wider, corolla tube is flat. **Labellum width** 0.45-1.2 cm, **Pistil** 2.1-3.6 cm, **Stamens** A type **Filaments** 0.3-0.55 cm, **Anther** 0.2-0.35 cm. **Bracts** 1.1-5.8 x 0.7-2.6 cm, ovate veya wider ovate. **Bracteoles** 0.4-1 x 0.3-0.6 cm. **Seeds** 0.2-0.3 x 0.15-0.25 cm, triagular, oval, dark brown or black.

Table 4. Morphological measurements of *Salvia tomentosa* compared with previous studies.

	Characteristics Min. - Max. (cm)	Our results	Flora of Turkey (1982) results	Doğan et all. (2008) results	Karabacak (2009) results
PLANT	Plant length	55-90	*	*	*
ROOT	Root length	12-27	*	*	*
STEM	Stem length	41-82	<100	<100	30-100
	Stem width	0.2-0.5	*	*	*
LEAF	Number of leaves	5-9	*	*	*
	Leaf length	4.6-11.5	2-11	0.8-11	1.5-12
	Leaf width	1.5-4.6	0.8-5	0.5-6	0.8-5
	Petiole length	0.5-4.3	1.7-5.5	0.8-6	1.8-4.5
INFLORESCENCE	Number of verticillasters	2-7	*	*	6-9
	Internodes length	0.7-4.8	*	*	1-6
	Flowers number in a verticillaster	1-12	4-10	4-10	4-10
FLOWER	Calyx length	1.1-1.5	1.2-1.8	0.7-1.8	1-1.8
	Length of calyx teeth	0.25-0.6	*	*	0.2-0.4
	Pedicel length	0.15-0.7	0.5-1	0.2-1	0.3-1
	Corolla length	2.2-4	2.5-3	2.1-3	2.5-3.5
	Pistil length	2.1-3.6	*	*	*
	Filament length	0.3-0.55	*	*	*
	Anther length	0.2-0.35	*	*	*
	Labellum width	0.45-1.2	*	*	*
BRACT	Bract length	1.1-5.8	0.5-0.8	0.3-2	0.5-1.2
	Bract width	0.7-2.6	0.4-0.8	0.2-1.1	0.4-0.8
BRACTEOLE	Bracteole length	0.4-1	*	*	*
	Bracteole width	0.3-0.6	*	*	*
SEED	Seed length	0.2-0.3	0.35	0.35	0.35
	Seed width	0.15-0.25	0.32	0.32	0.32

* These data were not recorded in previous studies.

Flowering period: April- September; **Habitat:** Lakeside, meadow, roadside, forest; **Altitude**: 1056 m; **Location:** Sakarya Akyazı Dokurcun district 12 km, Sülüklügöl; **Date of collection:** 10/VII/2016; **Herbarium number:** DUOF 8787. The general view of the species is given below (Image 2).



Image 2. General view of *Salvia tomentosa*.

***Salvia virgata* Jacq.**

Plant 32.5-91.5 cm, perennial, semi bushy, dense secretion and cover hairy (Table 5). **Root** 3-24.5 cm, main root is long taproot, side roots are thin. **Stem** 26-78.8 x 0.2-0.5 cm, mostly unique, sometimes multiple, upright, four cornered, moslty branched above. **Leaves** simple, below 4.8-13.5 x 2.1-8.7 cm gathered in the form of rosette shape, on the stem 2.4-11.5 x 1.1-6 cm, towards the top, dimensions and stems shrink, sometimes stemless close to flower, ovate, wider ovate, top of the leaf is acute, leaf sides are irregular lobed erose crenate, leaf floor is rotundate or cordate. Leaf surface covered with covering and glandular hair. **Petiol** between 0.2-8.5 cm. **Inflorescence** paniculate, **Verticillasters** 3-7 flowered, 4-20 on a branch, 0.2-3.4 cm spaced. **Pedicel** 0.1-0.2 cm. **Calyx** 0.5-0.85 cm, greenish violet colored, tubular campanulate, longer and thicker in the fruit, inner and outger surface covered with dense glandular and covering hair, ipper lip is shorter than lower lips and it has three teeth close eachother. Middle tooth is shorter than others, curved backward on the fruit, bisulcate, lower lip has two teeth, **Calyx teeth** 0.15-0.3 cm, longer on the fruit. **Corolla** 1.2-1.8 cm, lilac-purple, lilac colored, rarely white, two-lipped, upper lip is two lobed, falcate, lower lip is three lobed and middle lob is wider, corolla tube is clustered (ventricose), no annulus, **Labellum width** 0.45-0.8 cm, **Pistil** 1.2-1.85 cm. **Stamens** B type, almost the same length on the upper lips, lower theca reduced, **Filaments** 0.5-0.7 cm, **Anther** 0.15-0.25cm. **Bracts** 0.4-5.9 x 0.2-2.9 cm, ovate-acuminate, **Bracteoles** 0.4-0.9 x 0.25-0.55 cm. **Seeds** 0.15-0.2 x 0.1-0.15 cm, dark brown or black, oval.

Table 5. Morphological measurements of *Salvia virgata* compared with previous studies.

Characteristics Min. - Max. (cm)		Our results	Flora of Turkey (1982) results	Doğan et all. (2008) results	Karabacak (2009) results
PLANT	Plant length	32.5-91.5	*	*	*
ROOT	Root length	3-24.5	*	*	*
STEM	Stem length	26-78.8	30-100	10-100	20-160
	Stem width	0.2-0.5	*	*	*
LEAF	Number of leaves	5-9	*	*	*
	Leaf length	2.4-13.5	5-30	3.7-30	5-30
	Leaf width	1.1-8.7	2-15	2-15	2-15
	Petiole length	0.2-8.5	1-15	1-15	1-15
INFLORESCENCE	Number of verticillasters	4-20	*	*	*
	Internodes length	0.2-3.4	*	*	*
FLOWER	Flowers number in a	3-7	2-6	2-6	2-6
	Calyx length	0.5-0.85	0.6-1.2	0.5-1.2	0.6-1.2
	Length of calyx teeth	0.15-0.3	*	*	0.4
	Pedicel length	0.1-0.2	0.1-0.25	0.1-0.3	0.1-0.3
	Corolla length	1.2-1.8	1.2-1.5	1.2-2	1.2-1.5
	Pistil length	1.2-1.85	*	*	*
	Filament length	0.5-0.7	*	*	*
	Anther length	0.15-0.25	*	*	*
	Labellum width	0.45-0.8	*	*	*
BRACT	Bract length	0.4-5.9	0.4-0.8	0.2-1	0.4-0.8
	Bract width	0.2-2.9	0.35-0.6	0.2-0.9	0.35-0.6
BRACTEOLE	Bracteole length	0.4-0.9	*	*	*
	Bracteole width	0.25-0.55	*	*	*
SEED	Seed length	0.15-0.2	0.25	0.25	0.25
	Seed width	0.1-0.15	0.2	0.2	0.2

* These data were not recorded in previous studies.

Flowering period: May- September; **Habitat**: Lake surroundings, meadow, roadside, sub-forest; **Altitude**: 1056 m; **Location:** Sakarya Akyazı Dokurcun district 12 km, Sülüklügöl; **Date of collection:** 10/VII/2016; **Herbarium number:** DUOF 8786. The general view of the species is given below (Image 3).



Image 3. General view of *Salvia virgata*.

***Salvia forskahlei* L.**

Plant 36-93 cm, perennial, semi bushy, dense secretion and cover hairy (Table 6), **Root** 9-25 cm, taproot, side roots awailable. **Stem** 21-85 x 1.5-3.5 cm, upright, mostly unique, sometimes multiple, four cornered, usually branched abowe. **Leaves** simple or lyrate, usually gathered in the form of rosette shape at the bottom, 6.2-24.3 x 3.7-16 cm, on the stem 2-21.6 x 1.1-9.1 cm, towards the top, dimensions and stems shrink, elliptic, ovate, wider ovate, sometimes cordate, acute at the top, obtuse, leaf floor is rotundate or cordate, sometimes acute, sides crenate, undulate, leaf surface covered with dense covering and glandular hair, **Petiole** between 0.5-18.5 cm. **Inflorescence** paniculate, **Verticillasters** 1-10 flowered, 3-16 on a branch, 1.1-4.6 cm spaced. **Pedicel** 0.2-0.6 cm. **Calyx** 0.65-1.1 cm, ovate-campanulate, green or greenish underside, dark violet to the top, long and thick in the fruit, , inner and outger surface covered with glandular and covering hair, two-lipped, upper lips is slightly shorter than lower lip and has three teeth, lower lip has two teeth, **Calyx teeth** 0.2-0.4 cm, longer on the fruid. **Corolla** 1.8-3 cm, violet-purple, lilac colored, yellow with white dots, two-liped, upper lip is falcate (helmet shaped) and deep slottet two lobed, lower lip is three lobed, corolla tube is curved upward, no annulus, **Pistil** 2.3-3.3 cm, **Stamens** B type, lower theca reduced, **Filaments** 0.6-1.3 cm, **Anther** 0.2-0.4 cm. **Bracts** 0.4-2.25 x 0.25-1.5 cm, ovate or wider ovate. **Bracteoles** 0.3-0.8 x 0.3-0.5 cm. **Seeds** 0.15-0.2 x 0.1-0.15 cm, oval, triangular, dark brown or black.
Flowering period: May- September; **Habitat**: Creek beds, meadow, roadside, sub-forest, hazelnut grove, light shade and damp places; **Altitude (hight)**: 344 m; **Location:** Sakarya Sapanca Mahmudiye district Dereiçi area; **Date of collection:** 07/VIII/2016; **Herbarium number:** DUOF 8788. The general view of the species is given below (Image 4).



Image 4. General view of *Salvia forskahlei*.

Table 6. Morphological measurements of *Salvia forskahlei* compared with previous studies.

Characteristics Min. - Max. (cm)		Our results	Flora of Turkey (1982) results	Doğan et all. (2008) resuts	Karabacak (2009) results
PLANT	Plant length	36-93	*	*	*
ROOT	Root length	9-25	*	*	*
STEM	Stem length	21-85	15-120	15-120	35-120
	Stem width	1.5-3.5	*	*	*
LEAF	Number of leaves	4-11		*	*
	Leaf length	2-24.3	5-30	5-30	8-30
	Leaf width	1.1-16	3-23	3-23	1-23
	Petiole length	0.5-18.5	10-16	10-16	10-16
INFLORESCENCE	Number of verticillasters	3-16	*	*	*
	Internodes length	1.1-4.6	*	*	*
	Flowers number in a	1-10	2-12	2-12	2-12
FLOWER	Calyx length	0.65-1.1	1-1.3	0.8-1.3	0.8-1.3
	Length of calyx teeth	0.2-0.4	*	*	
	Pedicel length	0.2-0.6	0.2-0.5	0.2-0.6	0.2-0.6
	Corolla length	1.8-3	2-3	2-3	2-3
	Pistil length	2.3-3.3	*	*	*
	Filament length	0.6-1.3	*	*	*
	Anther length	0.2-0.4	*	*	*
BRACT	Bract length	0.4-2.25	0.8	0.8	0.8
	Bract width	0.25-1.5	0.6	0.6	0.6
BRACTEOLE	Bracteole length	0.3-0.8	*	*	*
	Bracteole width	0.3-0.5	*	*	*
SEED	Seed length	0.15-0.2	0.2	0.2	0.2
	Seed width	0.1-0.15	0.2	0.2	0.2

* These data were not recorded in previous studies.

***Salvia sclarea* L.**

Plant 85-135 cm, biennial or perennial, semi bushy, rough looking, very dense covering and glandular hair (Table 7), **Root** 24-37.5 cm, main root is long taproot, thin side roots awailable. **Stem** 53.5-104 x 0.5-1 cm, upright, thick, four cornered, moslty unique, çoğunlukla tek, the stem roof is wide, multi branched above. **Leaves** simple, 5.5-18.2 x 3.6-13.5 cm, towards the top, dimensions and stems shrink, wide ovate, cordate, acute on the top, acuminate, obtuse, leaf floor is rotundate, cordate, cordate-truncate, sides crenate-eros, dentate, mostly irregular lobed, leaf surface is covered with glandular and covering hair. **Petiole** between 0.9-17 cm. **Inflorescence** paniculate, **Verticillasters** 1-6 flowered, 3-10 on a branch, 0.5-3.6 cm spaced. **Pedicel** 0.2-0.5 cm. **Calyx** 0.8-1.3 cm, ovate-campanulate, green colored, longer and thick in the fruit, inner and outger surface covered with dense glandular and covering hair, two liped, upper lip is shorter than lower lip, has equal three teeth, sometimes middle tooth is blunt, lower lip has two teeth, **Calyx teeth** 0.35-0.6 cm, longer on the fruid. **Corolla** 1.7-2.4 cm, white, lilac or lilac-purple colored, two-liped, upper lip usually lilac-purple color, two lobed and falcate, lower lip usually cream or white, three lobed, middle lob is wider, corolla tube is clustered (ventricose), squamulate, no annulus, **Labellum width** 0.8-1.3 cm. **Pistil** 2.3-3.6 cm, **Stamens** B type, lower theca reduced, **Filaments** 0.7-1.8 cm, **Anther** 0.2-0.35 cm. **Bracts** 1.1-6.3 x 0.9-5.3 cm, white, pink or light purple shades, exceeding flowers., pellicular, ovate, acuminate. **Seeds** 0.25-0.3 x 0.2-0.25 cm, oval, triangular, dark brown.

Flowering period: May-August; **Habitat**: Sub forest, meadow, roadside; **Altitude**: 415 m; **Location:** Sakarya Taraklı Taraklı- Gölpazarı road; **Date of collection:** 03/VII/2017; **Herbarium number:** DUOF 8782. The general view of the species is given below (Image 5).



Image 5. General view of *Salvia sclarea*.

Table 7. Comparison of morphological measurements of *Salvia sclarea* with previous studies.

Characteristics Min. - Max. (cm)		Our results	Flora of Turkey (1982) results	Doğan et all. (2008) results	Karabacak (2009) results
PLANT	Plant length	85-135	*	*	*
ROOT	Root length	24-37.5	*	*	*
STEM	Stem length	53.5-104	<100	<100	<100
	Stem width	0.5-1	*	*	*
LEAF	Number of leaves	4-10	*	*	*
	Leaf length	5.5-18.2	8-14	8-14	8-14
	Leaf width	3.6-13.5	5-10	5-10	5-10
	Petiole length	0.9-17	3-9	3-9	3-9
INFLORESCENCE	Number of verticillasters	3-10	*	*	*
	Internodes length	0.5-3.6	*	*	*
FLOWER	Flowers number in a	1-6	2-6	2-6	2-6
	Calyx length	0.8-1.3	1-1.3	1-1.3	1-1.3
	Length of calyx teeth	0.35-0.6	*	*	*
	Pedicel length	0.2-0.5	0.2-0.3	0.2-0.3	0.2-0.3
	Corolla length	1.7-2.4	2-3	2-3	2-3
	Pistil length	2.3-3.6	*	*	*
	Filament length	0.7-1.8	*	*	*
	Anther length	0.2-0.35	*	*	*
	Labellum width	0.8-1.3	*	*	*
BRACT	Bract length	1.1-6.3	1.5-3.5	1.5-3.5	1.5-3.5
	Bract width	0.9-5.3	1-2.5	1-2.5	1-2.5
SEED	Seed length	0.25-0.3	0.3	0.3	0.3
	Seed width	0.2-0.25	0.2	0.2	0.2

* These data were not recorded in previous studies.

DISCUSSION AND CONCLUSION

In our study on *Salvia* species; important morphological characteristics of plants such as leaf shape, stamen type, calyx and corolla shape, brachial structure and number of flowers in a verticillaster were determined and the required morphological measurements were also compared with each other. In addition, our results were compared with other revision studies on Flora of Turkey and *Salvia* (Davis 1982, Karabacak 2009, Doğan et all. 2008).

The stem of *S. verticillata* subsp. *amasiaca* and *S. tomentosa* are mostly taller and clustered and the stem of other species are upright. *S. sclarea* is rather tall, upright and has thick stem compared to other species. Leaves are usually simple, *S. verticillata* subsp. *amasiaca* and *S. forskahlei* have irregular lobular lyrate leaves alongside simple leaves. Leaf shapes, dimensions, leaf edge, leaf top and leaf base types differ significantly between species. *S. forskahlei* and *S. virgata* have rosette shaped quite large base leaves collected at the base of the stem. The verticillary clusters of flowers have 1-12 flowers, *S. verticillata* subsp. *amasiaca* may have up to 46 flowers. Corolla is single shade such as purple, lilac and violet in all species, whereas in *S. sclarea* species, the upper lip is lilac-purple and the lower lip is white-cream colored. Corolla upper lip can be flat or helmet shaped, (*S. verticillata* subsp. *amasiaca* and *S. tomentosa* have flat upper lip and others have helmet shaped). Corolla tube is with a central design in *S. virgata*, curved up in *S. forshahlei* and flat in other species. Stamens are type C in

S. verticillata subsp. *amasiaca*, type A in *S. tomentosa* and type B in others. Bracts are longer than flowers, have membran structure and they are white, pink or purple colors in *S. sclarea*, it is different from other taxa. Except *S. sclarea* other taxa have bracteoles (Table 1, 2).

It was observed that the morphological characteristics and the measurement values were largely consistent with the data of Flora of Turkey and other *Salvia* revision studies (Davis 1982, Karabacak 2009 and Doğan et all. 2008), but there were some deviations in the minimum and maximum limits of the measurement values . For example, leaf sizes measured smaller than the previous studies while the sizes of the bracts are much larger. Similarly, in our study, it was observed that petioles may be shorter than previous studies and even there are sessile leaves. In this study, more detailed measurements were done on the different parts of plants, especially flower, inflorescence and the distinctive features of the species were more clearly demonstrated (Table 3-7).

The reason of these differences in morphological measurements can be explained by the variation of species, the number of samples examined, altitude and vegetation periods.

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