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# *Cultivation Opportunities Of Sideritis Tmolea (Lamiaceae)*

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**Abstract – *Sideritis* species belonging to the Lamiaceae family, locally known as "Dağ Çayı", "Yayla Çayı" and "Adaçayı", are generally consumed as a medicinal tea. *Sideritis tmolea* is a perennial endemic species known as "Sivri Çay" around Bozdağlar Ödemiş, İzmir; It is among the endangered species due to excessive grazing pressure, afforestation works, unconscious and uncontrolled collection. With this study, some agronomic characteristics of *S. tmolea*, which grows as a natural local endemic in Bozdağ, were examined and the possibilities of cultivation under culture conditions were investigated. The study was established in Ege University Ödemiş Vocational School trial field and Ege University Botanical Garden-Herbarium Research and Application Center with 3 replications. The plant's agronomic characteristics were determined by measuring the number of shoots, plant height, plant surface area, green herb yield, and drug-herb yield values. With the seeds collected from Bozdağlar populations, germination studies with 3 replications were carried out in petri dishes and viols in 2 different photoperiods, 12 hours light-12 hours dark, and 24 hours dark, and temperature values of 10C°, 20C° and 25C°. As a result of the evaluation, it was determined that the plants obtained from the cuttings were more efficient in terms of drug herb yield than those obtained from the seeds, but the survival success of the plants obtained from the seeds was higher. In light of these data, it has been determined that the plant can be cultivated in Ödemiş conditions. It has been concluded that the species can be evaluated in terms of its continuity in the natural population and as an alternative product for the local farmer.**

**Keywords – Sivri çay, Yayla çayı, cultivation, Lamiaceae**

## I. INTRODUCTION

The genus *Sideritis* is in the Lamiaceae family and is represented by 45 species and 53 related taxa in Turkey. The number of endemic taxa is 40 [1]. It is one of the important medicinal and aromatic plant genera, whose gene center is Anatolia, due to the high number of taxa and the high endemism rate (75%).

Infusions in folk medicine that are prepared from teas of these species; are used as a diuretic, pain reliever, antispasmodic, carminative, sedative, cough suppressant, and stomachic, in the treatment of colds and gastrointestinal diseases [2]. *Sideritis congesta* in Mersin region, *S. libanotica* in Mersin and Antalya regions, *S. libanotica* subsp. *linearis* in Mersin, Konya, and Afyon regions, *S. pisidica* in the Antalya region is used in making tonic and is consumed as a tea, and *S. pisidica* is used against abdominal pain in the form of porridge in the Konya region [3].

Various studies have been conducted on multiple biological activities of *Sideritis* species, such as antimicrobial, antioxidant, anti-inflammatory, antispasmodic, anti-ulcerative, nervous system stimulant, anticonvulsant, carminate, analgesic, and sedative effects [4]. The European Medicines Agency has defined herb of the species *S. scardica*, *S. clandestina*, *S. raeseri*, *S. syriaca* as a traditional herbal medicinal product in indicated indications only for long-term use to relieve cough associated with colds and mild gastrointestinal discomfort [5]. Many chemical compounds such as terpenes, flavonoids, essential oil, iridoids, coumarins, lignans, and sterols have been identified in the *Sideritis* genus. While diterpenes, flavonoids, and essential oils are found in almost every species, they are also responsible for pharmacological activity. *Sideritis* species grown in Turkey have a rich yield and essential oil composition [4].

The fact that *S. tmolea* is a single-point endemic and its distribution area and population density are low, causes limited studies on the species. Although there are no studies agronomy and adaptation on the species. However the researchers investigated that the essential oil ratio and components of *S. bilgerana*, *S. tmolea*, and *S. congesta* species collected from nature [4]. Accordingly, they determined the essential oil rate as 0.33% in *S. tmolea*, and forty-four components have been identified that makeup 89.6% of this oil. The essential oil components of the species are a-cadinol (21.9%), b-caryophyllene (10.6%), kalamenen (7.05%), muurrol 5-en-4-b-ol (7.05%), a-pinene (5.1%), sabinene (4.0%), b-caryophylene oxide (3.31%), terpinene-4-ol (2.49%), trans-sabinene hydrate (2.49%), cis-sabinene hydrate (2.08%), a-terpineol (2.03) %), muurol-5-en-4-a-ol (1.97%) and d-cadinene (1.92%).

In our country, 3-5 tons of cultivated *Sideritis* species and around 1 ton from those collected from nature, a total of 6 tons of *Sideritis* is used in the domestic market and exported annually [7]. *S. lycia* Boiss. &Heldr. and *S. stricta* [8] is among the *Sideritis* species cultivated from the Antalya region.

*S. tmolea* is a single-point endemic which has a distribution between 1450-2100 meters in İzmir, Ödemiş, Bozdağlar and is called 'Sivri Çay' by the local people. *S. tmolea* species is in the CR B1ab (i, ii, iii) (critical extinction) category according to IUCN Red List categories version 3.1 [9]. The species, whose flowering shoots are collected by the local people in July-August, is consumed as a tea against colds. In his study, it was aimed to remove the collection pressure of the single point endemic species and to be cultured for the continuity of its distribution.

## II. Material and Method

In this study, seeds collected from the natural subpopulation of *S. tmolea* species, which has a single point endemic showing natural spread in İzmir, Ödemiş, Bozdağlar, with coordinates of 38° 19'34"N / 28° 06' 22" E at an altitude of 1900 m, were used as study material (Figure 1), (Figure 2).

**A** **B**

Figure 1. A. S. tmolea general appearance, B. Flower axis

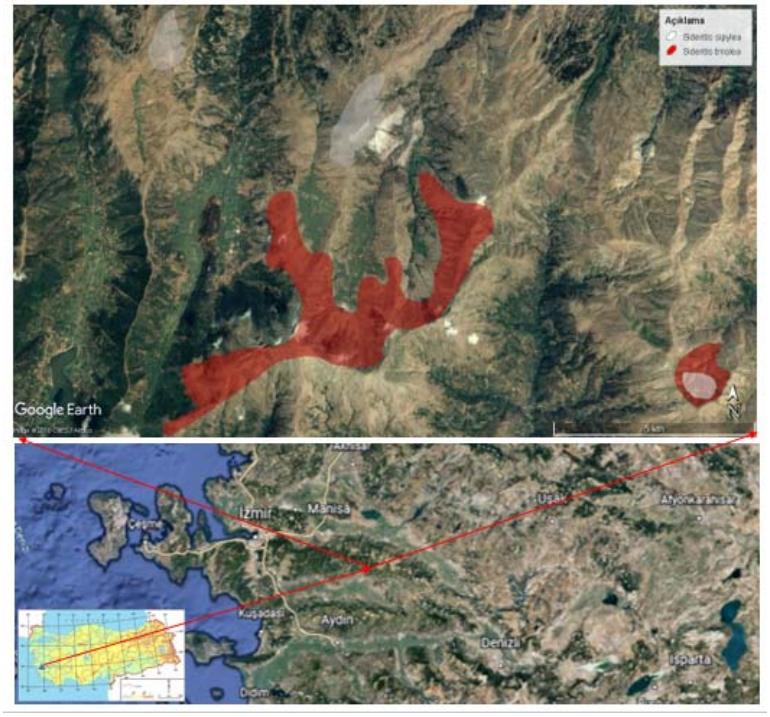


Figure 2. S.tmolea distribution area

The viols prepared in the climatization room were planted from the collected seeds, and the seedlings forming the production material were obtained. The resulting seedlings were transferred to pots, grown in greenhouse conditions, and used as steel rootstocks. The removed steels were immersed (quick deep) in 1000 ppm IBA (Indole Butyric Acid) solution and transferred directly to the soil pillows and rooted [10], [11]. With the seedlings obtained in the research, field trials were established in the Ege University Botanical Garden (height 10 m from the sea level) and Ödemiş Vocational High School (125 m), coincidence blocks were set 3 times according to the trial pattern. In the experiment established with seedlings produced from seeds and steel, plot sizes were 2.00 x 2.50: 5 $m^2$ and planted in 3 rows at a distance of 40x50 cm. Plantings took place between 1-10 April 2014. According to the needs of the plants, irrigation with a drip irrigation system and weed control were carried out at regular intervals.

The soil in Ödemiş location is sandy loam, organic matter rate is 1.34%, total nitrogen is 0.08% (low), phosphorus is 24 ppm (medium), potassium is 210 ppm (medium), total salt is 0.03% (unsalted), lime is %2,7 and pH 7.7 (normal). In the Bornova location, the soil is clayey-loamy, organic matter rate is 1.13%, total nitrogen is 0.01% (low), phosphorus is 0.4 ppm (medium), potassium is 400 ppm (high), total salt is 0.03% (unsalted).), lime 0.54%, and pH 8.2 (slightly alkaline).

The homogeneity test of all the data obtained in the study was performed using the SPSS 20.0 statistical package program, and then variance analysis was performed. Based on the significance of the analysis of variance, the groupings between the means were made using the Duncan multiple comparison test (α=0.01).

## III. Findings And Discussion

According to the results of the variance analysis of the examined features, location, and reproduction method; the number of shoots, plant height, and surface coverage was significant at the P< 0.05 level, while it differed at the P< 0.01 level for green herb and drug herb. Averages and difference groupings are given in (Table 1) and (Table 2).

Table 1. Means and difference groupings of shoot number, plant height, and surface area characteristics of *S. tmolea* plant in different locations and propagation methods

| | **Number of Shoots (Number/Plant)** | | | **Plant Height (cm)** | | | **Surface Coverage (cm2)** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Seed** | **Cutting** | **Average** | **Seed** | **Cutting** | **Average** | **Seed** | **Cutting** | **Average** |
| **Ödemiş** | 56,5 | 65,8 | 61,2 a | 52,3 | 46,8 | 49,6 a | 2695,6 | 2831,1 | 2763,3 b |
| **Bornova** | 22,2 | 23,8 | 23,0 b | 45,7 | 46,1 | 45,9 b | 4047,4 | 2859,7 | 3453,6 a |
| **Gen. Avg.** | 39,4 b | 44,8 a | 42,1 | 49,0 a | 46,4 b | 47,7 | 3371,5 a | 2845,4 b | 3108,4 |
| F Value | 1.181* | | | 1.034* | | | 1.971* | | |
| CV (%) | 6.80 | | | 12.52 | | | 22.33 | | |

When Table 1 is examined, the number of shoots was higher in Bornova and Ödemiş locations than the production with cuttings compared to the production with seeds. Production with cuttings provides an advantage in terms of time when the seed's germination and subsequent shoot formation process are considered. Therefore, this result is in the expected direction. The fact that *S. tmolea* is an endemic species suggests that there may be some obstacles to the early development of the plant after germination. When examined in terms of location, it is seen from the chart that the Ödemiş location gives approximately 3 times more shoots compared to Bornova in seed and steel production.

Considering that *S. tmolea* is endemic to Bozdağlar, it can be said that the difference between Ödemiş location and Bozdağ, which is the distribution area of the plant, has similar soil characteristics. Regarding plant height, the Ödemiş location gave statistically high values for seed production. When the surface coverage area is evaluated, it is seen that the coverage area of the plant is wider in Bornova conditions. This is because the plant grows more horizontally in Bornova conditions compared to Ödemiş. This developmental difference is thought to be due to the soil structure. When the surface coverage areas are evaluated according to the propagation patterns, it can be seen from the table that the plants produced with seeds develop more dispersed and statistically different.

Table 2. Means and difference groupings of fresh herb yield and drog herb yield characteristics of *S. tmolea* plant in different locations and propagation methods

| | **Green Herb Yield (g/plant)** | | | **Drog Herba Yield (g/plant)** | | |
|---|---|---|---|---|---|---|
| | **Seed** | **Cutting** | **Average** | **Seed** | **Cutting** | **Average** |
| **Ödemiş** | 112,6 | 165,7 | 139,1 a | 38,7 | 56,5 | 47,6 a |
| **Bornova** | 70,6 | 79,6 | 75,1 b | 26,5 | 28,8 | 27,6 b |
| **Gen. Avg.** | 91,6 b | 122,6 a | 107,1 | 32,6 b | 42,6 a | 37,6 |
| F Value | 4.528** | | | 4.050** | | |
| CV (%) | 16.14 | | | 13.94 | | |

When green herb yields are examined from Table 2, it is seen that higher yields are obtained in the Ödemiş location compared to the Bornova location. Here again, it can be suggested that the soil characteristics of Bozdağlar, which is the natural distribution area of the plant, and Ödemiş are similar as a reason. When the green herb yield is examined in terms of production methods, it is observed from the chart that production with cuttings provides higher yields compared to production with seeds. In production with cuttings, plants develop faster than in production with seeds. In production with cuttings, the plant is expected to complete only root development, while in production with seeds, it is expected to complete both root and stem development. Therefore, perennial plants show faster growth in steel production. The results did not change in the Drog herb yields and it was observed that the yield was proportionally higher in the Ödemiş location than in the Bornova conditions, as in the green herb yield. In terms of production methods, it was observed that production with cuttings gave statistically different results in drug yield as well as green herb yield.

The researchers conducted similar adaptation studies with endemic *S. congesta* and *S. condensata* species. While the essential oil content of the cultured *S. congesta* species is 0.11%, it is 0.027% in the samples collected from nature; For *S. condensata*, while the essential oil rate in cultivated plants was 0.016%, it was determined as 0.020% in those collected from

nature [12]. In the other study researchers tried limited irrigation and full irrigation applications in conventional and organic production in their study on the *S. perfoliata* subp. *perfoliata* taxon. This study reported that restricted irrigation increased the dry matter yield and essential oil content while negatively affecting the basic parameters of plant growth [13].

## IV. Conclusion And Recommendations

Many studies show that essential oil yield and components increase due to stress conditions in plants collected from natural flora and with limited irrigation. For this reason, while the priority should be to ensure continuity in nature for endemic species that are planned to be cultured, it brings to mind agronomic practices and breeding studies to obtain economic returns secondarily.

In this context, the *S. tmolea* species, which constitutes the material of the study, is one of our endemic species, single-point endemic, and critically endangered (CR). In the Species Action Plan study completed in 2018, according to this plan, the species is distributed with 2980 individuals in an area of 14.74 $km^2$ in İzmir Ödemiş Bozdağlar [9]. Again in the same study, the factors threatening the natural populations of the species listed such as; - Over-collecting by local people; - Afforestation activities; - Grazing pressure; - On the northern slopes of Bozdağ, activities for winter tourism (zoning activities for winter sports and activities for reducing the avalanche risk in the area). Considering these data about the species, this study is important because it formed the basis for obtaining ex-situ collections of the species. In light of these data, with the support of the Ministry of Agriculture and Forestry, the seedlings that will be produced with a planned and rapid production plan can be transferred to the areas destroyed in their natural environment and as a result, the species can be returned to its natural environment with strong populations.

After ensuring the continuity of natural populations and/or by establishing breeding trials with seedlings to be obtained simultaneously, breeding studies of the species can be started and variety development projects can be carried out. Thus, the possible varieties to be obtained can be evaluated by the local people as alternative products in and around Ödemiş.

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