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Morphological, Anatomical and Chorologic Studies On *Satureja coerulea* Janka*

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Abstract: *Satureja coerulea* was thought to be extinct due to urbanization in recent years. It was collected from two new localities in Kırklareli far from its locality given in Flora of Turkey. In this study distribution, detailed morphological and anatomical features, diagnostic characters of *S. coerulea* growing around Thrace have been carried out. Drawings of general appearance leaf, bract, flower, calyx and corolla of the plants are also given. In addition, transverse sections of stems and leaves were examined anatomically.

Key Words: Anatomy, *Labiatae*, Morphology, *Satureja coerulea*

Satureja coerulea Janka Üzerinde Morfolojik, Anatomik ve Korolojik Araştırmalar

Özet: Satureja coerulea'nın son yıllarda, şehirleşme nedeni ile yok olduğu sanılıyordu. Bu tür, Flora of Turkey'de gösterilen lokalitelerden farklı olarak, Kırklareli'nde iki yeni bölgeden toplanmıştır. Bu çalışmada, Trakya bölgesinden toplanan S. coerulea'nın tanıtıcı karakterleri, ayrıntılı morfolojik ve anatomik özellikleri ile dağılışı incelenmiştir. Bitkinin yaprak, brakte, çiçek, kaliks ve korolla gibi organlarının morfolojik özellikleri çizilmiştir. Gövde ve yaprak kısımlarından alınan enine kesitler anatomik olarak incelenmiştir.

Anahtar Sözcükler: Anatomi, Labiatae, Morfoloji, Satureja coerulea

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Introduction

The genus *Satureja,* according to Flora of Turkey, is represented by 13 perennial and one annual species (Davis *et al.*, 1988). These species are primarily distributed in west and south Anatolia, and also found in East, North and Central Anatolia. But only one species (*S. icarica*) is found in the Aegean Island. (Davis *et al.*, 1988; Tutin *et al.*, 1972). The number of *Satureja* species in Turkey were increased to 15 by our recent investigation in Eagean and Mamara regions (Tümen *et al.*, 2000; Başer *et al.* 2000). Five species of *Satureja* genus are endemic and the percentage of the endemism is 33 %.

Systematic studies on the genus *Satureja* are presented in various flora and publications (Feinbrun-Dothan, 1964; Tutin *et al.*, 1972; Davis, 1988; Strid and Tan, 1991). The first detailed information on species of *Satureja* growing in Turkey was given in Flora Orientalis by Boissier (1879). The Author had described 15 species and 8 of which are distributed in Turkey. Later, by Hayek (1931) provided some information on *Satureja* species collected in Turkey.

Morphological and anatomical studies on some *Satureja* species were investigated by Kaya *et al.* (1994), Başer *et al.* (2000) and Satıl *et al.* (2002) in recent years. *S. coerulea* was collected the first time from around İstanbul-Anadolu Hisarı in 1867 by Ball. Also the species were distributed in the Bulgaria and Romania.

In this study distribution, morphological and anatomical characters and ecological information of *S. coerulea* were given.

Material and Methods

Satureja coerulea was collected from Kırklareli-Demirköy by us. Also some specimens were collected by Dirmenci. Voucher specimens are deposited in the herbarium of the Faculty of Pharmacy of Anadolu University, in Eskişehir, Turkey (Acronym: ESSE) and in Biology Department of Balıkesir University. Descriptions are based on living and herbarium materials. All measurements were made directly on herbarium specimens. Wild M5 A Stereomicroscope with drawing tube and Nikon Eclipse E 600 research microscope were used in morphological and anatomical studies.

Results

Morphological Results

***Satureja coerulea* Janka** in Velen., Fl. Bulg. 465(1891).

The following description is based on our own observations and that of in the Flora of Turkey (Davis, Mill & Tan, 1988):

Plant perennial, suffruticose, 6-25 cm. **Stem** ascending or procumbent, slender simple or branched upwards, covered with puberulous-hirsute. **Cauline leaves** pale green, oblong-linear, outer leaves big, 16-11 x 2.0-2.3 mm, inner leaves smaller, 6-4 x 1.0-0.4 mm, sessile, apex obtus, acute, entire, cuneate at base, often ciliate. **Bracts** lanceolate, 2-9 x 0.5-1.2 mm. **Bracteoles** c. 3.5 mm, as long as calyx. **Inflorescens** generally long, 3-12 cm, mostly congested at apex. Verticillasters 10-25, 2-flowered. **Calyx** light-green, 2.5-4 (-5) mm, subactinomorphic, gamocephalous, 10 veins, five teeth, teeth 1/3-2/5 x calyx, lanceolate-subulate, glabrous. **Corolla** light purple, 6-9 mm, tube exserted from calyx, gamopetalous, bilabiate. **Stamens** 4, didinamous, exserted from upper lip. **Nutlets** light brown, 0.6-1.2 x 0.3-0.8 mm, obovate (Figure 1).

Flowering period: August-October.

Anatomical Results

Stem: Transverse sections taken from the middle part of the stem (annual) were observed as follows (Figure 2-3):

The epidermis is composed of a single layer cells and rectangular or oval squashed cells. The outer walls of the epidermal cells ara thicker than the anticlinal walls. Upper surface is covered with a thick cuticle and contains rare eglandular hairs. Covering trichomes are unicellular or multicellular (up to 4) and are also covered with a thin cuticle. Bicellular hairs are more frequent. The collenchyma tissue which is irregular cells and located immediately under the epidermis is 5-7-layered on the corners and 1-3-layered in between the corners. Parenchyma tissue which is 1-2-layered and usually squashed. Single layered endodermis consists of rectangular cells. There is a (3-)1-2-layered cork tissue below endodermis. Pericycle is indistinguishable. Phloem is 8-13-layered and consists of irregular cells. Cambium is also not distinguished. Xylem comprises trachea and tracheids. Trachea are orbicular or ovoid while tracheids are polyhedral. Rays are usually uniseriate. Pith consists of large orbicular or polyhedral parenchymatous cells.

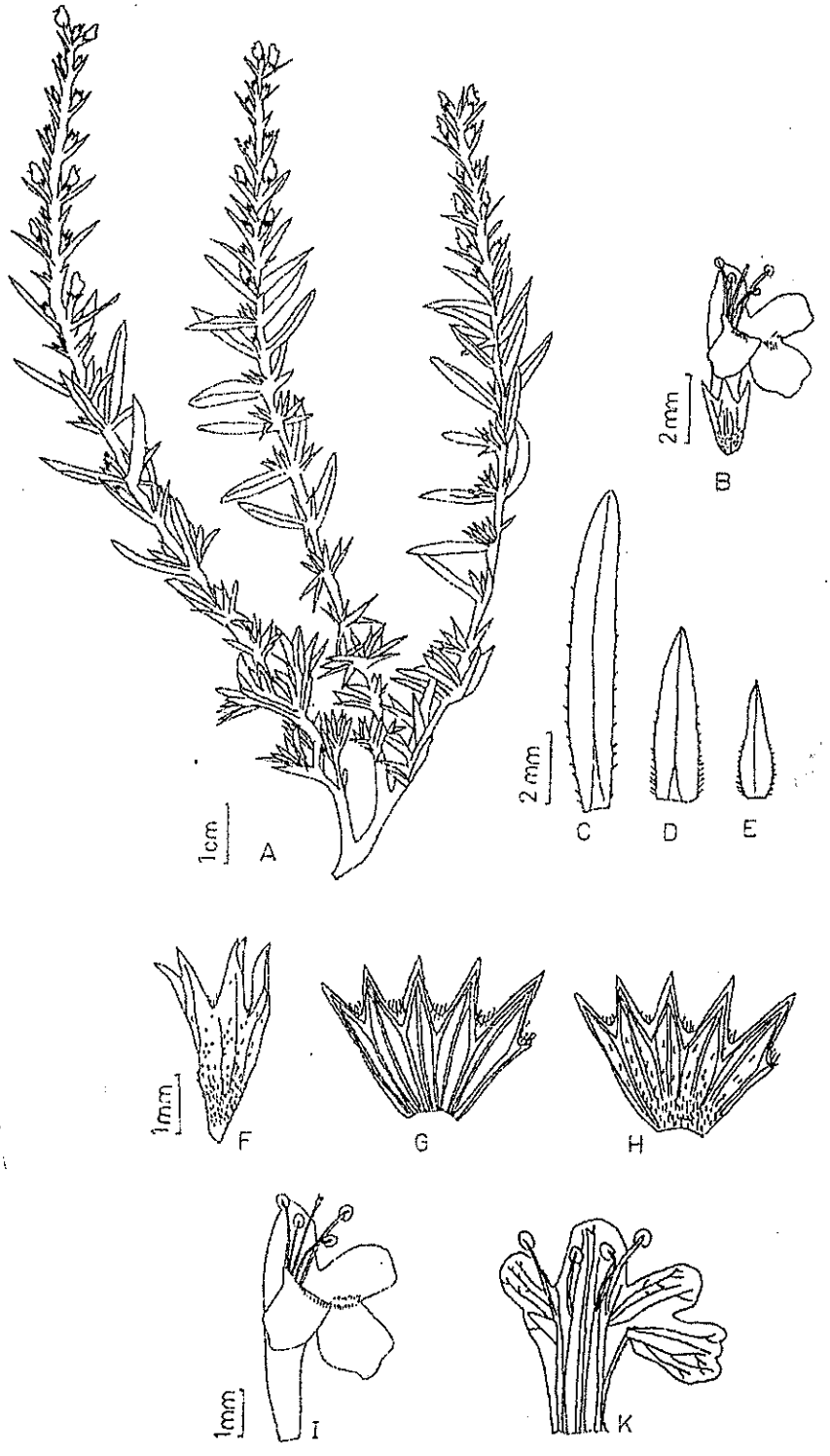

Figure 1: *Satureja coerulea* Janka (ESSE 1041), **A) Habit, B) Flower, C) Leaf, D) Bracte, E) Bracteol, F-H) Calyx, I-K) Corolla.**

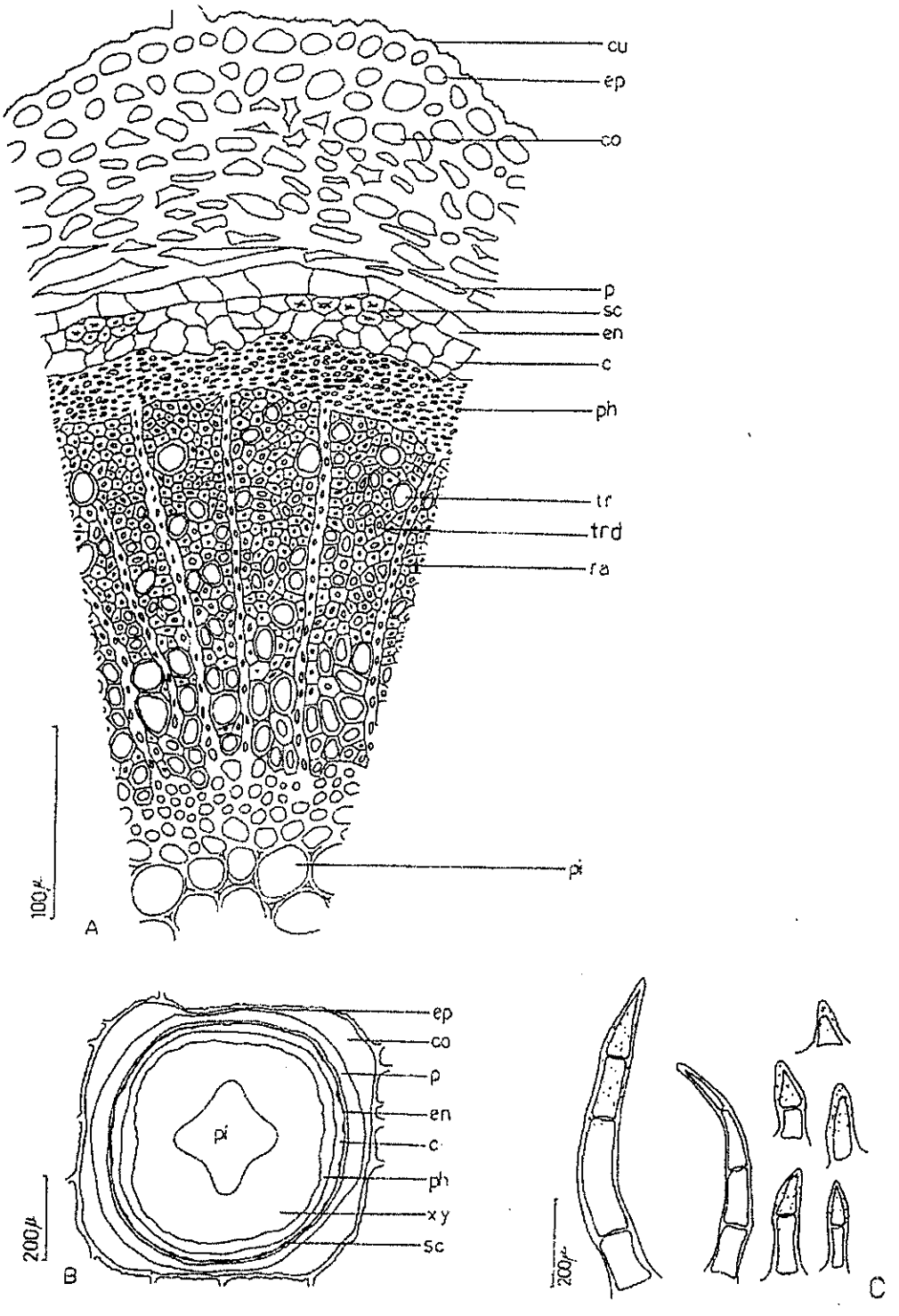

Figure 2: ***Satureja coerulea*** **Janka.:** A-B) Cross-section of stem, C) Hair types in stem cu-Cuticula, ep-Epidermis, co-Collenchyma, p-Parenchyma, en-Endodermis, sc: Sclerenchyma c-Cork, ph-Phloem, tr-Trache, trd-tracheid, ra-Rays, xy-Xylem, pi-Pith.

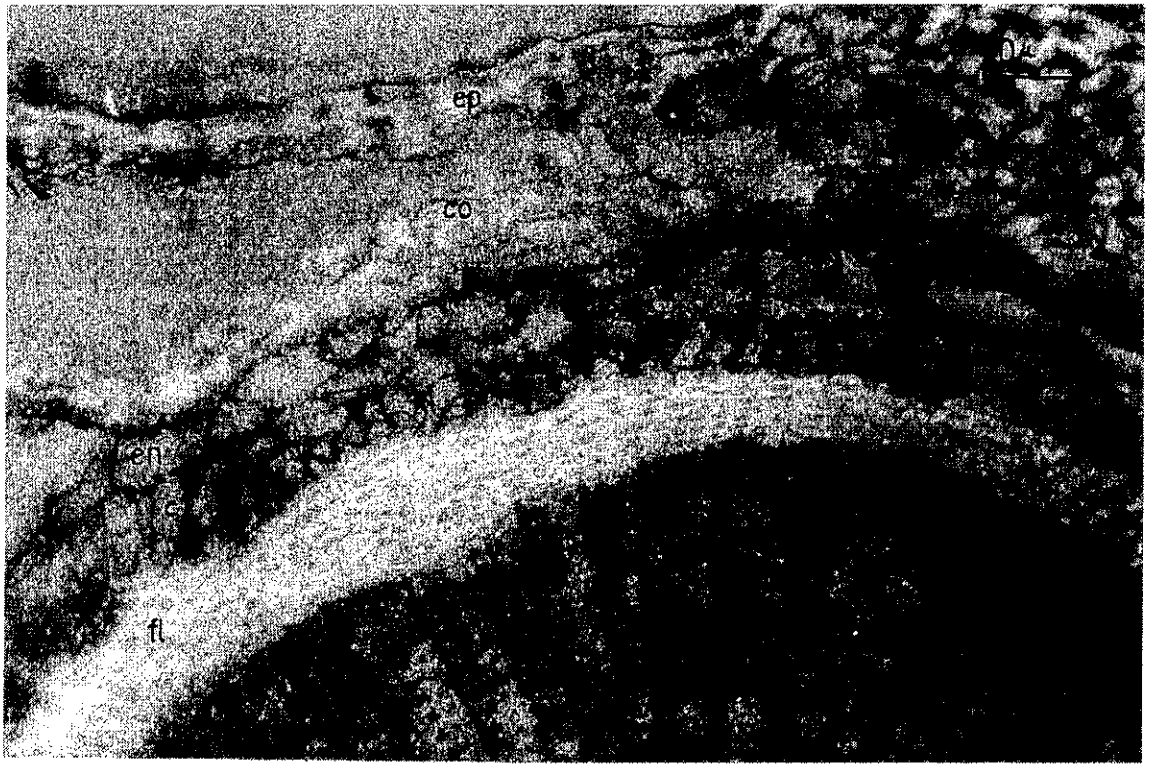

Figure 3: ***Satureja coerulea*** **Janka:** Cross-section of stem (10x40): ep-Epidermis, co-Collenchyma, en-Endodermis, sc: Sclerenchyma c-Cork, fl-Phloem, tr-Trache

Leaves: Transverse sections of the lamina and the midrib and surface preparations of both epidermis revealed the following elements (Figure 4-5):

In transverse section, upper and lower epidermis comprise uniseriate square and rectangular cells. Upper walls are thicker than lower and lateral walls. Both epidermis are covered with a thick undulate cuticle. There are rare glandular and eglandular hairs on the surfaces of both epidermis. Covering trichomes are 2-3 cellular. Unicellular hairs are more frequent. There are two types of glandular hairs; *Labiatae* type and head and stalk unicellular. They are embedded in the surfaces of both epidermis (Figure 6). Stomata type is diacytic (Metcalfe and Chalk, 1950) and occurs on the surfaces of both epidermis being more abundant on the lower surface. They are located on slightly higher from epidermal cells level. Mesophyll occurs 1, rarely 2 seriate palisade tissue and 2-3-seriate spongy parenchyma. Vascular bundles occur in a narrow area and are surrounded by bundle sheath. Sclerenchymatic tissue is present in vascular bundle. Central vessel is less-developed. Xylem faces towards the upper surface while phloem faces the lower epidermis. In the midrib region, there are parenchymatous cells under the upper and lower epidermis

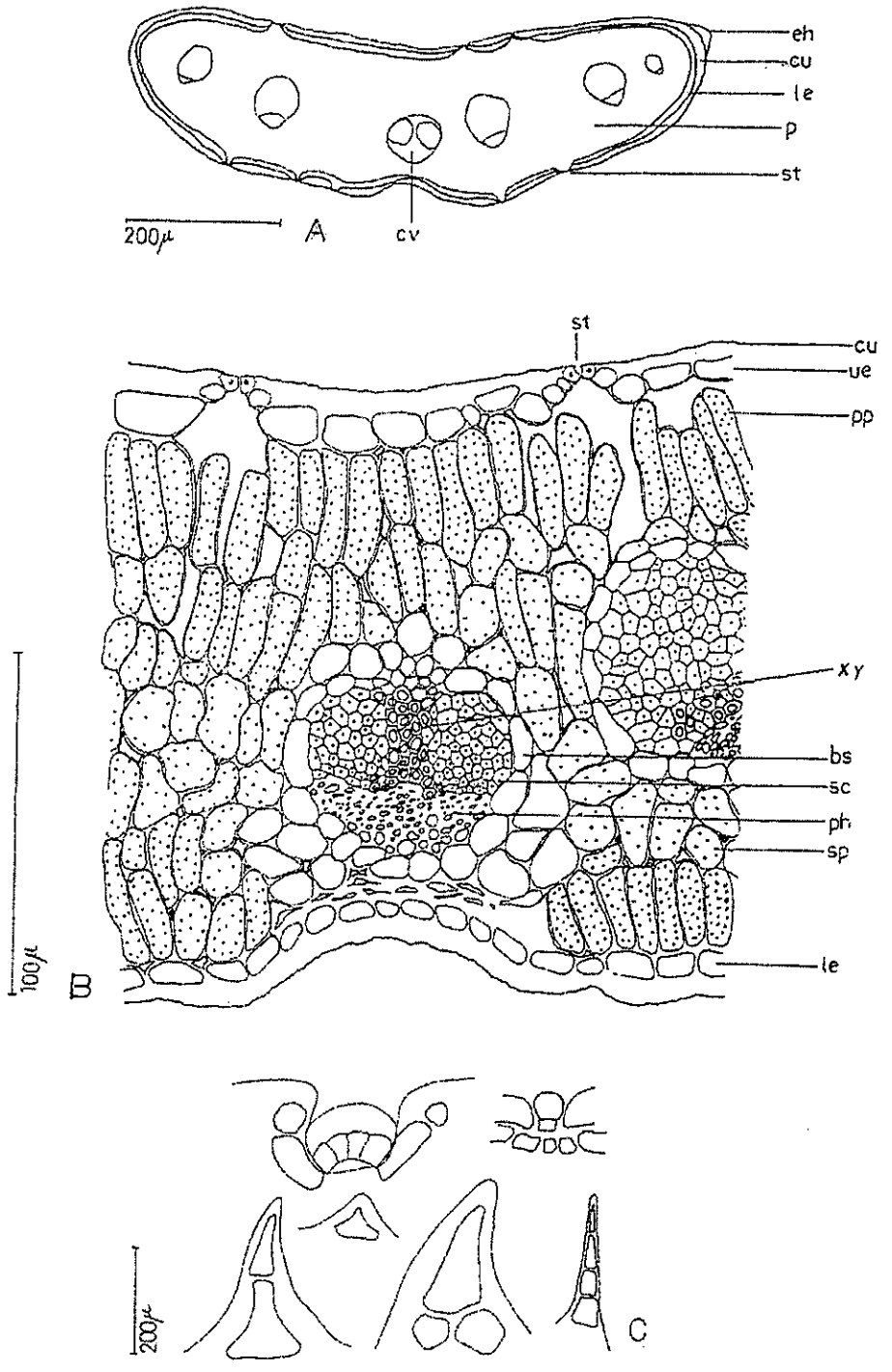

Figure 4: ***Satureja coerulea*** **Janka:** A-B) Cross-section of leaf, C) Hair types in leaf, eh-Eglandular hair, cu-Cuticula, ue-Upper epidermis, le-Lower epidermis, p-Parenchyma, pp-Palisade parenchyma, cv-Central vessel, xy-Xylem, bs-Bundle sheath, ph-Phloem, sc-Sclerenchyma, sp-Spongy parenchyma, st-Stomata

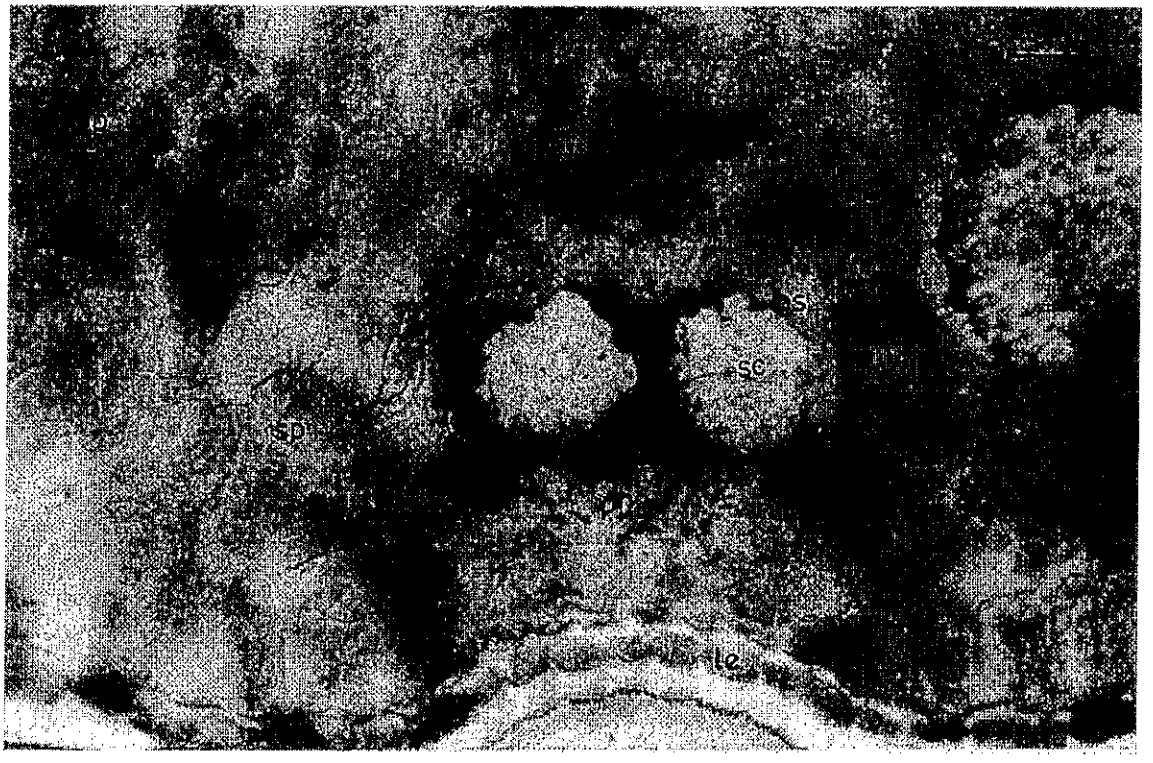

Figure 5: ***Satureja coerulea*** **Janka:** Cross-section of leaf (10x20) le-Lower epidermis, pp-Palisade parenchyma, xy-Xylem, bs-Bundle sheath, ph-Phloem, sc-Sclerenchyma, sp-Spongy parenchyma

Figure 6: ***Satureja coerulea*** **Janka:** Glandular hair in leaf (10x40) gh-Glandular hair, cu-Cuticula, ue- Upper epidermis, pp-Palisade parenchyma, st-Stomata

Habitat and Ecology

Limestone rocks and stonly, exposed granit slopes. It share its habitat with *Quercus* sp., *Sideritis scardica* ssp. *scardica*, *Thymus cherlerioides*, *Gramineae* spp, *Achillea* sp.

Distribution

Satureja coerulea, were the first collected from around İstanbul-Anadolu Hisarı (1867, J. Ball!) from Turkey.

A1 Kırklareli: Demirköy, Sarpdere village, slopes of Yıldız mountain, in cliff hills, 05.08.1995, G. Tümen 1041, F. Satıl, N. Batu; Between Kırklareli and Dereköy, 20. km, open *Quercus*, rocky places, 500 m, 29.10.2001, T. Dirmenci.

Also the species were distributed in the Bulgaria and Romania.

Discussion

Until now, the species has been known according to the records in the Flora of Turkey, İstanbul-Anadolu Hisar. However, it could not be recollected in this region in recent years. We attempted to study the population in this locality several times, unfurtunately we could not find it.

S. coerulea is classified as 'data deficient (DD)' in nonendemic rare plants in according to the recent "Türkiye Bitkileri Kırmızı Kitabı" by Ekim *et al.* (2000).

S. coerulea was reported during the project on *Satureja* in Thrace and West Anatolia (Başer *et al.*, 2000). The species was collected from two new locality in Kırklareli far from knowning locality in Flora of Turkey. But these new localitions are very narrow. Each field is around 2 000-3 000 m^2 and the distance between them is about 40 km the spreading field of species is approximately 3-4 thousand km^2 (with-length:10x40).

The plant is not tall enough, one of the species is near the Kırklareli-Bulgaria road, the other one is near the cave road which is recently opened for touristic purpose in Sarpdere village, both field are pastured by animals and used by people as named "Keklik otu", thus it is thought that the habitat may be destroyed and the population of plant may become less. So, the species must be classified in 'endangered (EN)' (criterion B1), (Ekim *et al.* 2000).

The gathering differs from the Balkan material seen in its less acute leaves and shorter bracts (Davis, Mill & Tan, 1988). The morphological characteristics could be dependent on the type of habitat.

There is no difference in stem and leaf anatomy of *S. coerulea* than *S. parnassica* subsp. *sipylea* and *S. cuneifolia* species. However, sclerenchymatic tissue is present in vascular bundle in *S. coerulea* and *S. parnassica* subsp. *sipylea*, while it is not found in *S. cuneifolia*. Covering trichomes are rare in *S. coerulea* than of *S. cuneifolia* and *S. parnassica* subsp. *sipylea* (Kaya *et al.*, 1994; Satıl *et al.* 2002).

S. coerulea was thought to be extinct due to urbanization in recent years. The species has to be protected immediately.

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