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Morphological and Anatomical Studies on *Thymbra sintenisii* Bornm. & Aznav. (Labiatae)

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Abstract: *Thymbra sintenisii* Bornm. & Aznav. (Labiatae) is a perennial shrub and is represented in Turkey by 2 subspecies (subsp. *sintenisii* and subsp. *isaurica* P.H.Davis). In this study, samples collected from different localities were investigated morphologically and anatomically. The morphological features of various organs of the plant such as the stem, leaf and flower are given in detail. In anatomical studies, transverse sections of the stems, leaves and calyx are illustrated.

Key Words: *Labiatae*, *Thymbra sintenisii*, Morphology, Anatomy

Thymbra sintenisii Bornm. & Aznav. (Labiatae) Üzerinde Morfolojik ve Anatomik Çalışmalar

Özet: *Thymbra sintenisii* Bornm. & Aznav. Türkiye'de iki alttürle (subsp. *sintenisii* ve subsp. *isaurica* P.H.Davis) temsil edilen ve çalimsı çok yıllık bir bitkidir. Bu çalışmada, farklı lokalitelerden toplanan örnekler morfolojik ve anatomik olarak incelenmiştir. Bitkinin gövde, yaprak ve çiçek gibi değişik organlarının morfolojik özellikleri ayrıntılı olarak verilmiştir. Anatomik çalışmalarda, bitkinin gövde ve yaprak kısımlarından alınan enine kesitler çizimlerle gösterilmiştir.

Anahtar Sözcükler: *Labiatae*, *Thymbra sintenisii*, Morfoloji, Anatomi

Introduction

The family *Labiatae* plays an important role as a source of medicinal and aromatic plants of commercial importance. *Thymbra* L. is one of those aromatic genera. *Thymbra* (Labiatae) is represented by the following 2 species and 4 taxa in the Flora of Turkey (Davis, 1982): *T. spicata* L. (var. *spicata*, var. *intricata* P.H.Davis) and *T. sintenisii* Bornm. & Aznav. (subsp. *sintenisii*, subsp. *isaurica* P.H.Davis). They are among the sources of commercial thyme in Turkey and are found in areas with a Mediterranean climate (Baytop, 1963). Dried leaves and inflorescences are known as Zahter or Sater in South-Eastern Anatolia and are used as an antiseptic and stimulating herbal tea. Other Turkish names are: Karabaş kekik and Sivrikekik (Baytop, 1999). Essential oil of the aerial parts of *T. sintenisii* was analysed (Başer et al., 1976; Başer et al., 1977). Morphological and anatomical aspects of *Thymbra spicata* were previously investigated (Erken, 2001). Here, we report on the morphological

and anatomical features of *T. sintenisii* subspecies *sintenesii* and subspecies *isaurica*.

Materials and Methods

Study materials were collected from the localities listed below and voucher specimens were deposited at the Herbarium of the Faculty of Pharmacy, Anadolu University, Eskişehir, Turkey (ESSE). Herbarium numbers of the plants studied are given at the end of the figure legends. A distribution map of *T. sintenisii* is given in Figure 1.

The materials necessary for anatomic studies were protected in 70% alcohol and morphological studies were carried out on herbarium materials. Suitable sections were taken from these materials for microscopic studies. Transections of the stem, leaf and calyx and upper and lower surface sections of the leaf were taken manually for anatomical studies. The materials were stained with

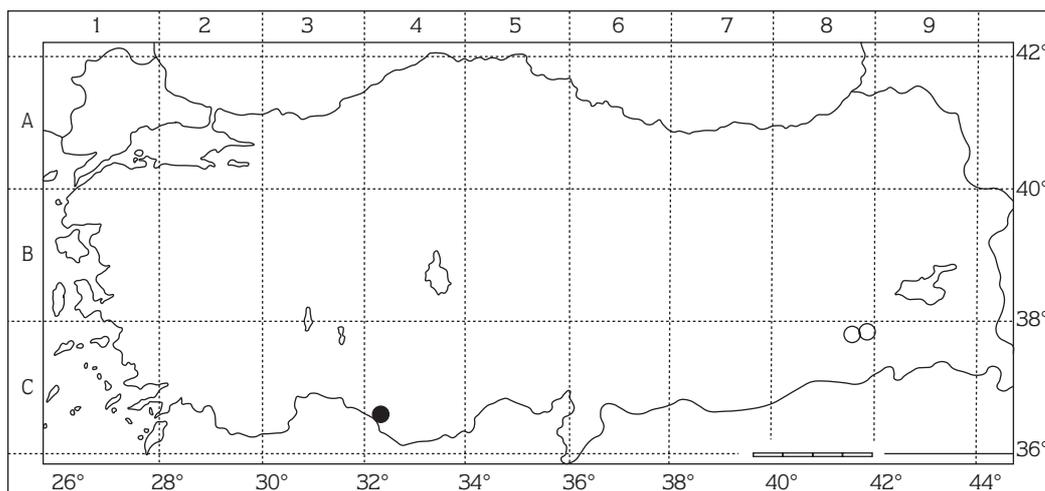


Figure 1. Distribution of *T. sintenisii* Bornm. & Aznav.
 o *T. sintenisii* subsp. *sintenisii* • *T. sintenisii* subsp. *isaurica*

Sartur reagent (Baytop, 1981) and fixed with glycerine-gelatine (Vardar, 1987). Illustrations were prepared with a Wild M5A stereomicroscope and Leitz SMLUX binocular light microscope with drawing tube.

Studied Materials

T. sintenisii subsp. *sintenisii*

C8 Siirt: Kurtalan: Atabağlar village, 30.7.95, G. Tümen, ESSE 11946!. C8 Batman: around Hasankeyf 27.8.1995, G. Tümen, ESSE 11948!. C8 Batman: Hasankeyf castle 20.7.96, G. Tümen ESSE 12260!.

T. sintenisii subsp. *isaurica* P.H.Davis in Notes R.B.G. Edinb. 38: 59 (1980).

C4 Antalya: Alanya, between Yerköprü and Derince, Pinus nigra forests (1000-1050 m), 12.10.92, H. Duman ESSE 10601!. C4 Antalya: Alanya, Çökele to Gökbel (1350 m), 32 km from Alanya, 17.7.95, K.H.C. Başer, H. Duman, A. Altıntaş ESSE 11510!.

Morphological Properties

Thymbra sintenisii Bornm. & Aznav. in Feddes Rep. 10: 471 (1912).

Subshrubs. Stem erect, 9.5-29 cm, eglandular, hirsute, sparsely at base, dense at top. Leaves green, greyish-green, linear-lanceolate, decussate, apex acute, obtuse to rounded, margin entire, base obtuse, both surfaces covered with trichomes, reddish, stalked or sessile glandular hairs. Bracts lanceolate, apex acute, short hirsute on both surfaces, margins ciliate, glandular

hairs embedded. Bracteoles lanceolate, apex acute, shortly hirsute on both surfaces. Calyx tube dorsally compressed, gland reddish, embedded on both surfaces. Calyx throat long haired. Corolla white, bilabiate, with eglandular and reddish glandular hairs. Stamen pairs not exceeding upper lip. Anthers 0.5 mm, filaments 3-4 mm. Ovary 4 lobed, style 9 mm, stigma 1mm, bifid lobes unequal pair (Figures 2-5).

1. Stem erect, eglandular hairs recurved; leaves 6-11.5 x 2-2.5 mm. Bracts 6-7.5 x 1.5-2 mm, margins short ciliate; bracteoles 3-4.5 x 1 mm, margins short ciliate; calyx 5-6 x 2 mm, margins short hirsute; corolla 8 mm.

subsp. *sintenisii*

1. Stem erect, eglandular hairs short not recurved; leaves 6-17 x 2.5-3 mm; bracts 7.5-10 x 2 mm, margins with multicellular hairs; bracteoles 6-7 x 1-1.5 mm, margins long ciliate; calyx 6.5 x 2-2.5 mm, margins long hirsute; corolla 9 mm.

subsp. *isaurica*

Anatomical Properties

Both primary and secondary structures were observed in the upper part of the stem. In the median and lower parts only the secondary structure was visible. Since there was no difference between the 2 subspecies, only the drawings of subsp. *sintenisii* are given here.

Figure 2. *T. sintenisii* subsp. *sintenisii* A. Plant, B. Stem, C. Leaves, D. Bract, E. Bracteole, (ESSE 11946).

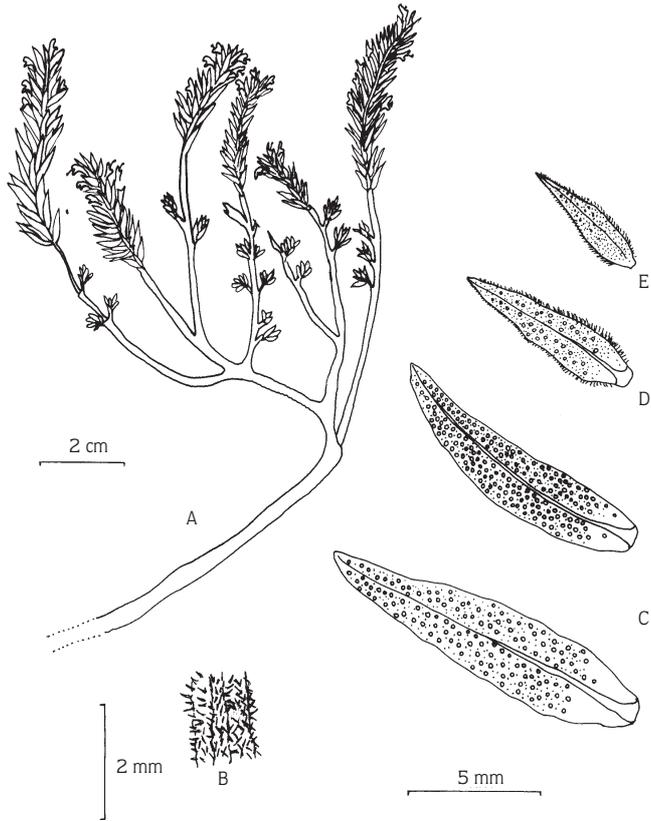


Figure 3. *T. sintenisii* subsp. *sintenisii* A. Flower, B. Dissected corolla, pistil and stamens, C. Calyx, D. Dissected calyx, (ESSE 11946).

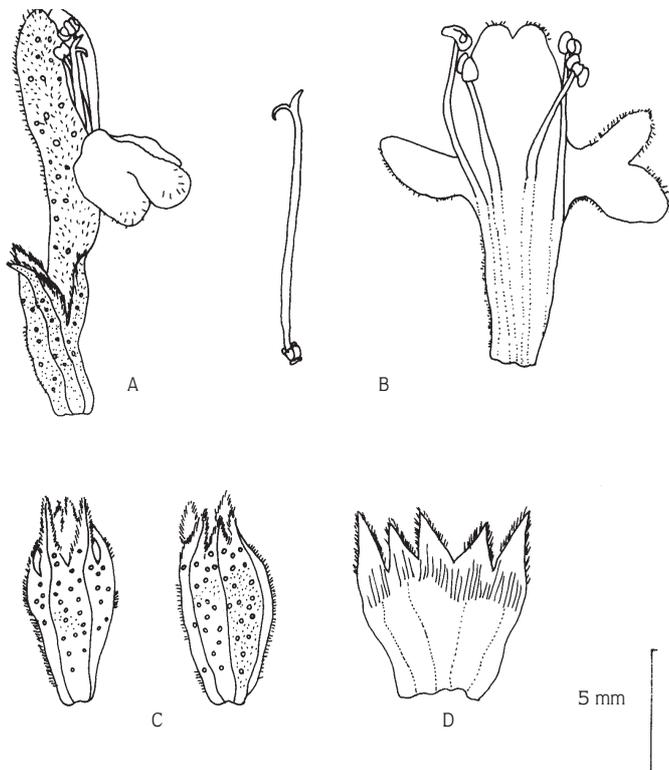


Figure 4. *T. sintenisii* subsp. *isaurica* A. Plant, B. Stem, C. Leaves, D. Bract, E. Bracteole, (ESSE 10601).

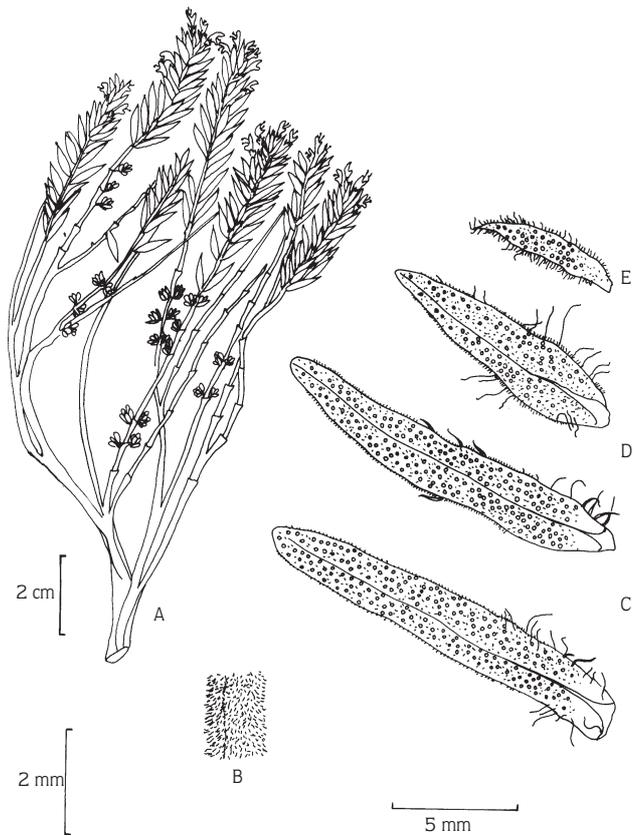
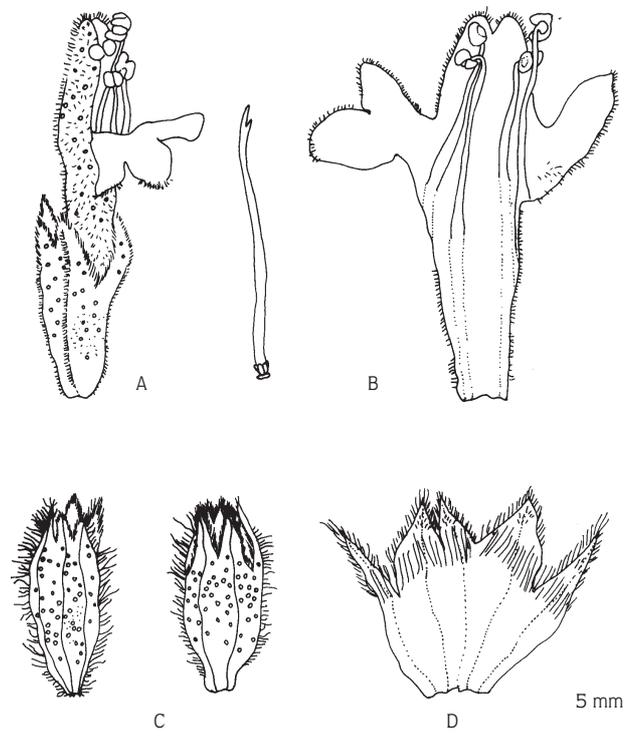


Figure 5. *T. sintenisii* subsp. *isaurica* A. Flower, B. Dissected corolla, pistil and stamens, C. Calyx, D. Dissected calyx, (ESSE 10601).



Stem: Epidermis was observed in transections. The epidermis is composed of a single layer of rectangular or compressed cells. They are covered with a thin cuticle. Eglanular hairs 1-2 celled, thick walled. The collenchyma tissues consisting of 2-3 layers of rectangular cells and irregular in shape are located under the epidermis. The 1-2 layered compressed parenchyma tissue is located under the collenchyma. There are sclerenchyma groups between the parenchymata. Endoderm is composed of a single

layer of rectangular cells. Phloem ring is composed of 4-5 layers of cells (Metcalf & Chalk, 1950). Cambium is not distinguishable (Figures 6,7).

Cells of peridermis cover a large area. Peridermis is observed in mature stems. Cork is composed of 2-4 layers of cells. Primary cortex and endodermis squashed. Secondary cortex composed of 6-7 layers of cells. Secondary xylem covers a large area with parenchymatous rays (Figure 8).

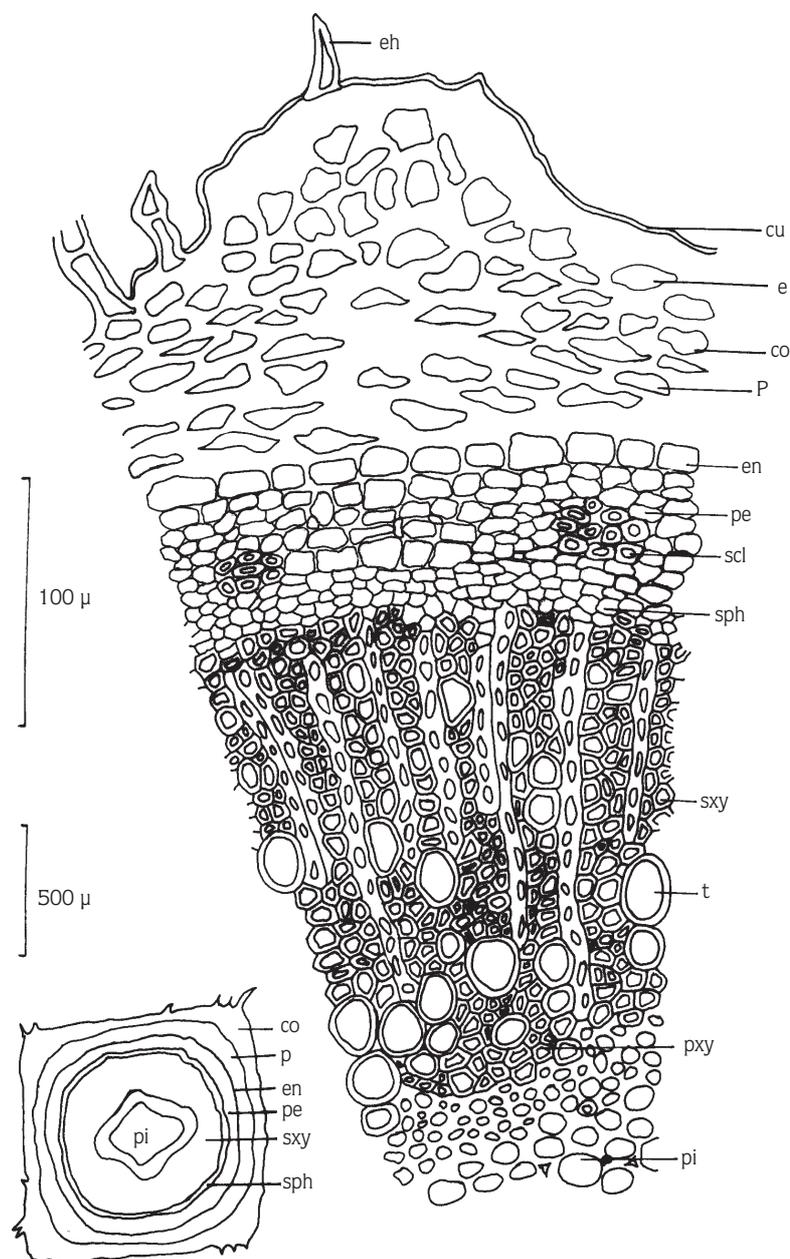


Figure 6. *T. sintenisii* subsp. *sintenisii*. Transection of the stem, eh. eglanular hairs, cu. cuticle, e. epidermis, co. collenchyma, p. parenchyma, en. endodermis, pe. pericycle, scl. sclerenchyma, ph. phloem, sxy. secondary xylem, t. trachea, pxy. primary xylem, pi. pith, (ESSE 11948).

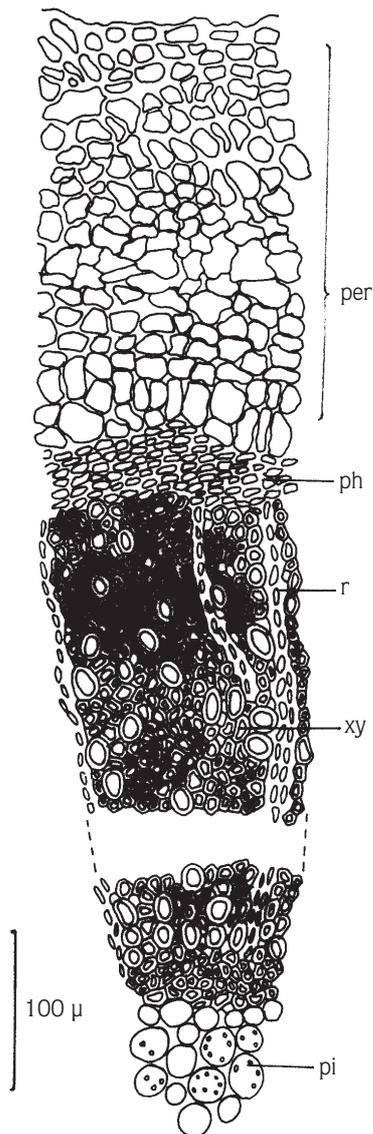


Figure 7 *T. sintenisii* subsp. *sintenisii*. Transection lower part of the stem, per. periderm, ph .phloem, r. rays, xy. xylem, pi. pith, (ESSE 11948).

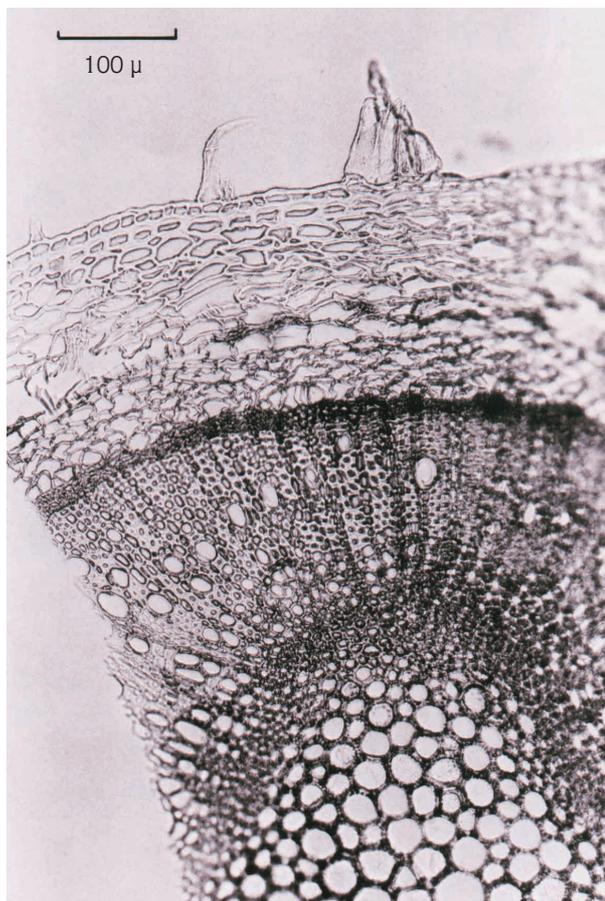


Figure 8. *T. sintenisii* subsp. *sintenisii*. Transection of upper part of the stem, (ESSE 11948).

Leaf: The leaf surface of *T. sintensisii* is covered with eglandular and glandular hairs. Hairs are dense on both surfaces of subsp. *isaurica*, sparse on the subsp. *sintensisii*. Eglandular hairs are conical, 1-2 celled. A thin cuticular layer is present on both surfaces of the leaves. The leaves are amphistomatic. In both subspecies the epidermal cells of the upper and lower sides are equal. Upper walls are thicker than the lower and radiating walls. On surface views, the upper and lower epidermis are flat walls and polygonal (Figures 9,10). Eglandular hairs are conical and 1-2 celled. Glandular hairs are on both sides (Figure 11). Stomata are diasitic. The mesophyll is differentiated into palisade and spongy parenchyma. The upper and lower

palisade have long rectangular parenchyma cells and contain chloroplast. In both subspecies the palisade is composed of 2 cell layers and the spongy parenchyma is situated between 2 palisade layers and consists of 2-3 layers of cells. It contains intercellular spaces.

Calyx: In the transection taken from the calyx, the cuticle is a thin layer. The upper epidermis cells are ovoid. The lower epidermis cells are long and cylindrical. The cell wall is thickened and the cell lumen narrow. The lower epidermis contains crystals. The upper epidermis is hairy while the lower epidermis is glabrous. Eglandular hairs at the calyx are 1-2 celled. Glandular hairs are 2 celled stalkes (Figure 11).

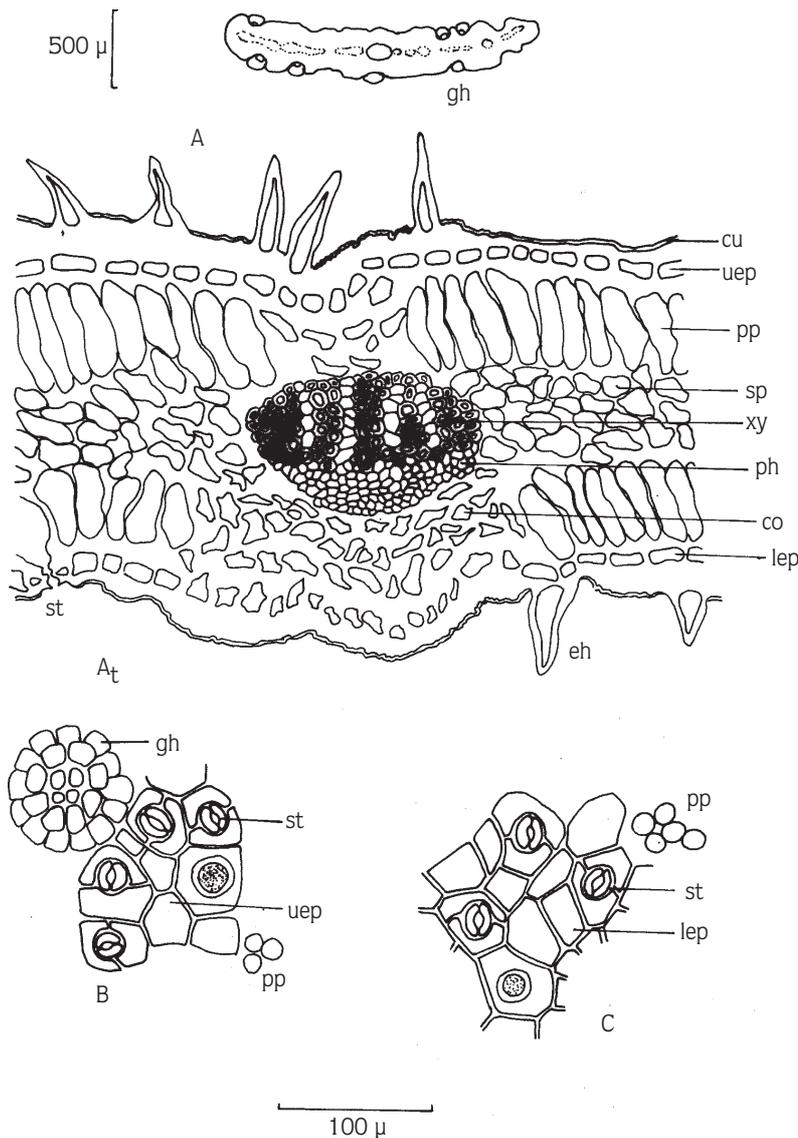


Figure 9. *T. sintensisii* subsp. *isaurica*. Transections of the leaf (A,A_t), Surface views of the upper (B), and lower (C) epidermis. cu. cuticle, uep. upper epidermis, pp. palisade parenchyma, xy. xylem, sp. spongy parenchyma, ph. phloem, lep. lower epidermis, eh. eglandular hairs, gh. glandular hairs, co. collenchyma, st. stoma, (ESSE 11510).

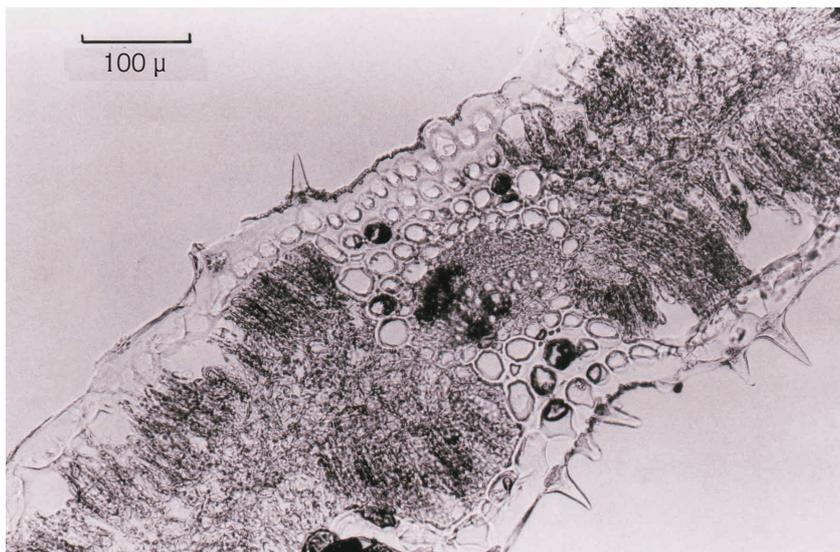


Figure10. *T. sintenisii* subsp. *isaurica*.
Transection of the leaf, (ESSE 11510).

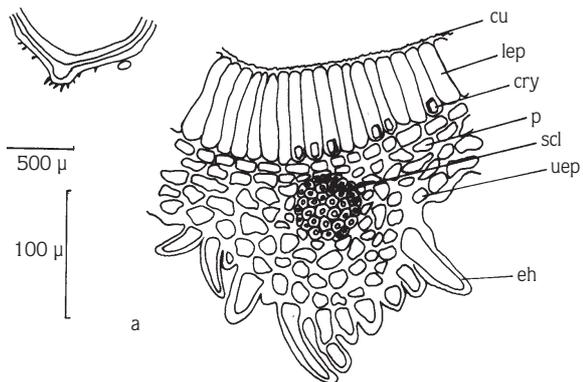
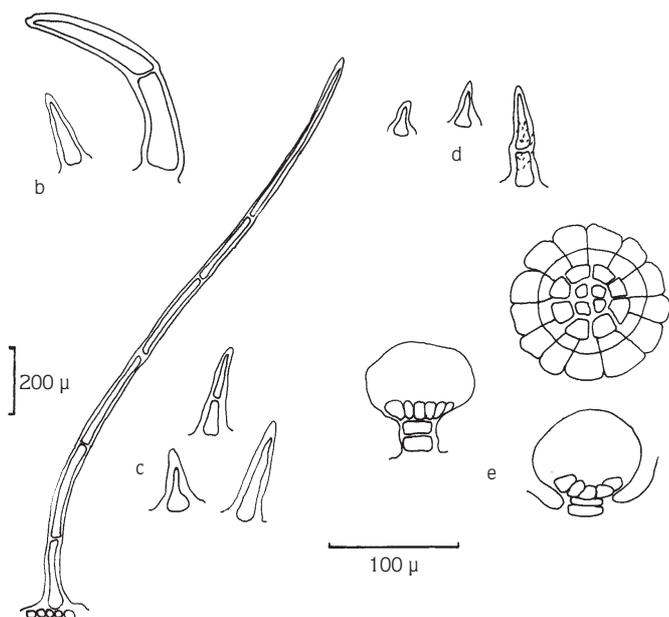


Figure11. *T. sintenisii* subsp. *sintenisii*. a) Transection of the calyx, b) Eglandular hairs of the stem, c) Eglandular hairs of the leaf, d) Eglandular hairs of the calyx, e) Glandular hairs of the calyx and leaf. cu. cuticle, lep. lower epidermis, cry. crystal, p. parenchyma, uep. upper epidermis, scl. sclerenchyma, eh. eglandular hairs, gh. glandular hairs, (ESSE 11948).



Results and Discussion

Two subspecies of *T. sintenisii* were investigated and compared anatomically and morphologically.

Some morphological differences were observed between the 2 subspecies *sintenisii* and *isaurica* in the size and density of hairs on the edges of bracts and bracteoles of the leaves on stems. Furthermore, leaf, bract and bracteole sizes clearly differ between in the 2 subspecies. These differences are shown comparatively in Table 1. Leaf, bract, bracteole and hair sizes in subsp. *isaurica* are greater compared to the other subspecies. These results show some discrepancy with those reported by Davis (1982) in which calyx and bracteole sizes were equal.

However, our studies indicated that calyx size was greater. Contrary to Davis's findings, bracteole size was equal to that of the calyx, not 1.5 to 2x that of the calyx in subsp. *isaurica*.

Anatomical investigations showed no difference between the 2 subspecies. However, leaves are dorsiventral in *T. sintenisii* while they were reported as isolateral in *T. spicata* (Erken, 2001).

Acknowledgement

I would like to thank A.Ü. BİBAM (Plant, Medicine and Scientific Research Centre) for taking the photos.

Table 1. *Thymbra sintenisii* species.

	<i>Thymbra sintenisii</i> subsp. <i>sintenisii</i>	<i>Thymbra sintenisii</i> subsp. <i>isaurica</i>
Stem	Leafy flowering shoots simple, eglandular hairs white recurved hirsute, 1-2 celled	Leafy flowering shoots simple, eglandular hairs white short hirsute, 1-2 celled
Leaf	Short hirsute, eglandular hairs 1-2 celled, glandular hairs 1-2 celled stalk	Short hirsute, pilose at base, eglandular hairs 1-2 celled, glandular hairs 2 celled stalk
Bract	6-7.5 x 1.5-2 mm Bract margins densely short ciliate	7.5 –10 x 2 mm Bract margins densely long ciliate
Bracteole	3-4.5 x 1 mm Bracteole margins densely short ciliate	6-7 x 1.5 mm Bracteole margins densely long ciliate
Flower	Verticillasters with 6-9 subsessile flowers, white corolla	Verticillasters with 6 subsessile flowers, white corolla
Calyx	5-6 x 2 mm Eglandular hairs 1-2 celled, glandular hairs 2 celled stalk	6.5 x 2-2.5 mm Eglandular hairs 1-2 celled, glandular hairs 2 celled stalk

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