

Morpho-Anatomical Studies on Endemic *Euphorbia anacampseros* Boiss. var. *tmolea* M.S. Khan

Ümmüşen Gökçen^{a,*} and Murat Ardiç^a

^a Eskişehir Osmangazi University, Department of Biology, 26480, Eskişehir-Turkey

*Corresponding author: ummusengokcen@gmail.com

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ABSTRACT

The genus *Euphorbia* which is belong to the family of Euphorbiaceae is represented about 2150 taxa in the World. *Euphorbia* genus shows wide distribution and it's members found in Madagascar, east Africa, Caucasia and Mexico. Number of *Euphorbia* taxa in Turkey is 120 and 18 of these are endemic. The most of these endemic taxa are distributed in Toros Mountains. In this study, a morphological feature of *Euphorbia anacampseros* var. *tmolea* which is the endemic perennial taxon from Turkey was investigated. Also some parts of this taxa biometrically measured. Seed's and caruncle's shape and size were investigated. Also all data obtained from morphological investigations were compared with literatures. Anatomical features of studied taxa were investigated and so photographed.

Keywords: Anatomy, Morphology, *Euphorbia anacampseros* Boiss. var. *tmolea* M.S. Khan

INTRODUCTION

Euphorbia L. genus, which is represented by approximately 330 genera and 8900 species in the world, is the richest genus of the family with approximately 2150 species. In Turkey is represented by 120 taxa, 18 are endemic to Turkey (Erdoğan et al. 2012).

The genus *Euphorbia* was officially introduced to the world of science on page 450 of the first edition of Species Plantarum, published in 1753 by Swedish botanist Carl Linnaeus (Doody, 2009) The genus *Euphorbia* consists of *Esula*, *Chamaesyce*, *Euphorbia* and *Rhizanthium* (Horn et al. 2012).

The species of *Euphorbia* which has a wide range from one-year plants to shrubs and trees, has a cosmopolitan spread throughout the world (Govaerts et al. 2000). Species of the genus are mainly spread to the tropical and subtropical regions of Africa and the Americas. (Bruyns et al. 2006). Many species of this genus are succulent by adapting to dry habitats (Zimmermann et al. 2010).

Since the genus *Euphorbia* has many species, it has many different forms in terms of morphological features (Can, 2012). They often contain branched milk pipes. *Euphorbia*'s latex which has irritant properties and has a strong laxative effect contains resin, rubber, starch, cyanide and enzymes. Milk is used externally against warts and as a pain reliever in rheumatic pains (Luković, 2009).

The use of latex found in *Euphorbia* species dates back to prehistoric times. Latex is an economically valuable substance. In daily life, tires, carpets, swimming goggles, tennis rackets, shoe soles, dish gloves, balloons, pacifiers, baby bottles, hot water bottles, erasers and belts; In the field of medicine, stethoscopes, gloves, tourniquets, injectors, surgical masks, protective goggles, respirators, anesthesia masks, catheters, wound resistors, injection ports and dental materials are some products using latex. (URL-2).

The flower structure of the genus *Euphorbia* is called siatium. Siatium, which resembles a hermaphrodite flower structure, is a specialized structure of highly reduced male flowers that surround a single female flower (Narbona, 2005; Küçüker, 2011; Patterson, 2017).

In all species of the Euphorbiaceae family, histologically, the seeds contain small radially elongated cells consisting of hard walls. (Tokuoka and Tobe, 2002). The fruits of the genus *Euphorbia* form three seeds and the seeds vary widely in size, shape and surface characteristics. The seeds are dispersed with the help of ants, thanks to the lipid and protein rich caruncula. The shape, color, surface characteristics and morphology of the caruncula of the seeds reveal the differences between taxa. Seeds are important in the diagnosis of *Euphorbia* plants and in the case of zookori (Can and Küçüker, 2013).

In this study, morphological investigations were carried out on *E. anacampseros* var. *tmolea* which is an endemic species for our country. It is thought that anatomical examinations of the genus will be used for the first time and will serve as a source for future studies.

MATERIALS AND METHODS

Endemic *E. anacampseros* var. *tmolea* samples used in the study were collected from 1200 m from Bozdağ Ski Resort Road of İzmir province on 12.08.2019. Some of the collected samples are transformed into herbarium material and stored in Eskişehir Osmangazi University Herbarium. Flora of Turkey and the East Aegean Islands were used during the identification of the samples.

In anatomical examination, materials which were stored in 70% alcohol were used. Photographs of cross-sections taken from roots, stem taken from leaves were taken with Nikon 80i type microscope with Kameram digital camera in Eskişehir Osmangazi University Faculty of Science and Letters Biology Department.

Morphological findings were obtained from measurements made from fresh plant samples. *Euphorbia* seed length, shape, surface decorations, color; the presence, absence, shape, length and color of the carunculus are important taxonomic characters used to systematically identify and compare species. In this direction for micromorphological studies, seed surfaces were imaged using SEM. The dorsal part was preferred for surface shoots due to the lack of micro-morphological differences between the dorsal and ventral surfaces of the seed.

RESULTS AND DISCUSSION

Morphological findings

Glabrous, glaucous, ascending, perennial. Stems ascending, 30-45 cm. Stems several, simple, arising from a woody stock. Cauline leaves to 40 mm, suborbicular, ovate, rhombic, obovate or obtrullate, apex obtuse and mucronate or acutely acuminate, minutely denticulate, cuneate or rounded, often purple-tinged. Ray-leaves suborbicular. raylet-leaves to 30 mm broad, ovate to reniform, rounded to cordate. Rays 3-5(-6), once or twice dichotomous; axillary rays 0-1. Glands 2-horned, horns clavate. Cyathial lobes prominent, broadly ovate, purplish. Fruit ovoid-conical, trigonous, 5-6 mm diam. Seeds subcylindrical, 3 mm, rugulose, grey or brown; caruncle terminal, petasiform, 1.5 mm (Fig. 1).

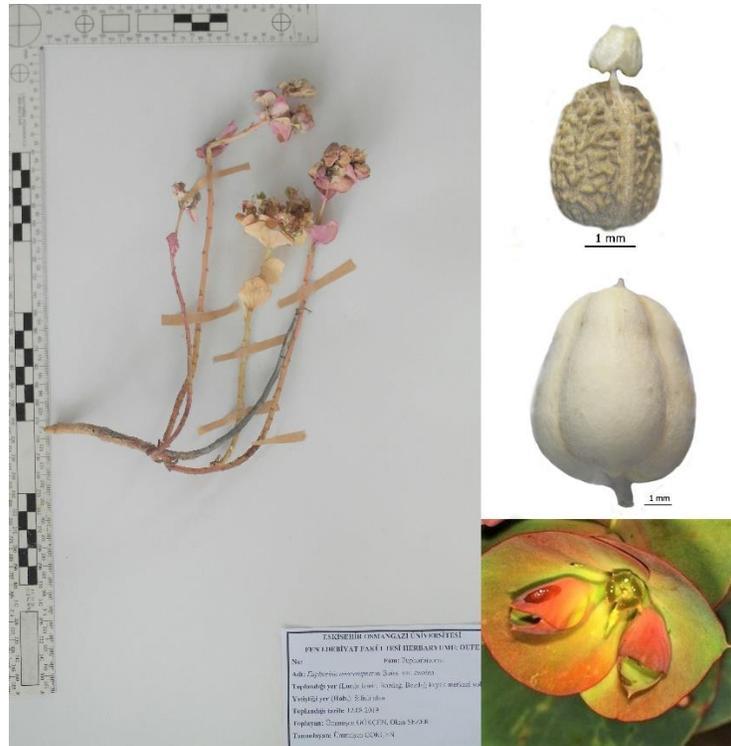


Fig. 1. *E. anacampseros* var. *tmolea* general view; seed; fruit; siliqua.

Anatomical Findings

Root Anatomy

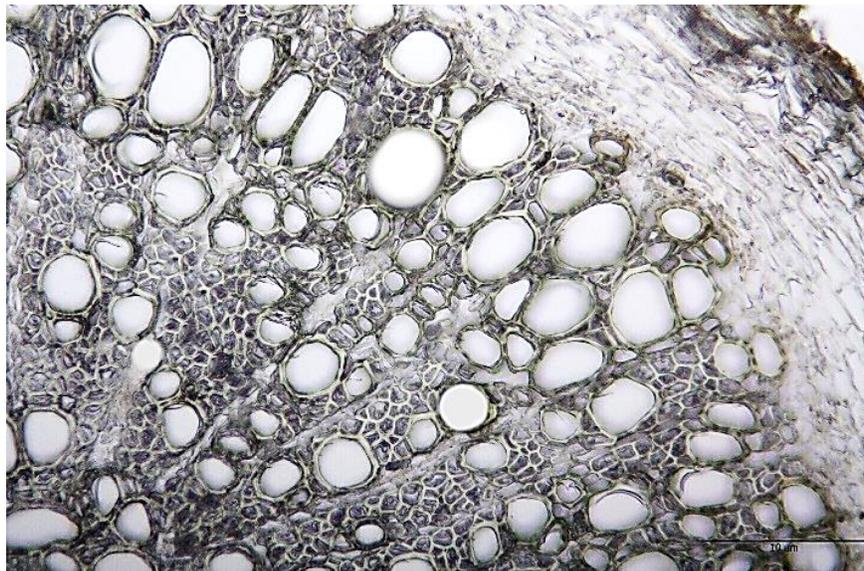


Fig. 2. *E. anacampseros* var. *tmolea* root anatomy.

When the cross-section taken from *E. anacampseros* var. *tmolea* root is examined, it is seen that the root shows secondary root structure. The outermost protective tissue is periderm. Immediately beneath the periderm layer is the crushed epidermis. Just below the epiderma is a layer of cortex composed of 6-8

rows of crushed parenchymatic cells. Phloem elements and cambium could not be clearly distinguished. The xylem elements are enlarged to cover the core and are thick-walled (Fig. 2).

Stem Anatomy

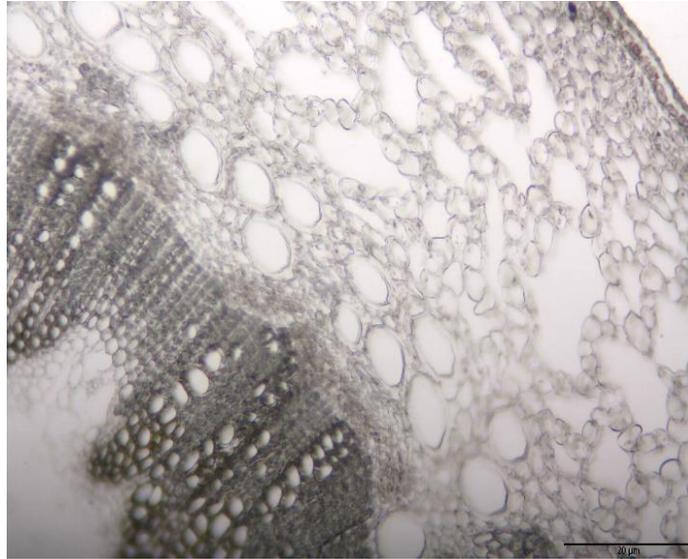


Fig. 3. *E. anacampseros* var. *tmolea* stem anatomy.

When the cross-section taken from *E. anacampseros* var. *tmolea* stem is examined epidermis layer consisting of single row of cells on the outermost part of the trunk cross-section. Under the epidermis is a single row of collenchyma cells. In the region up to the conduction bundles, there is a layer of cortex composed of 20-22 rows of large and small round-rectangular parenchymatic cells. The intercellular spaces in the cortex parenchyma are very wide. The transmission bundles are of the open-collateral type. Vascular cambium is seen in a narrow area under the phloem. Xylem is located under the vascular cambium layer. The core region is empty (Fig. 3).

Leaf Anatomy

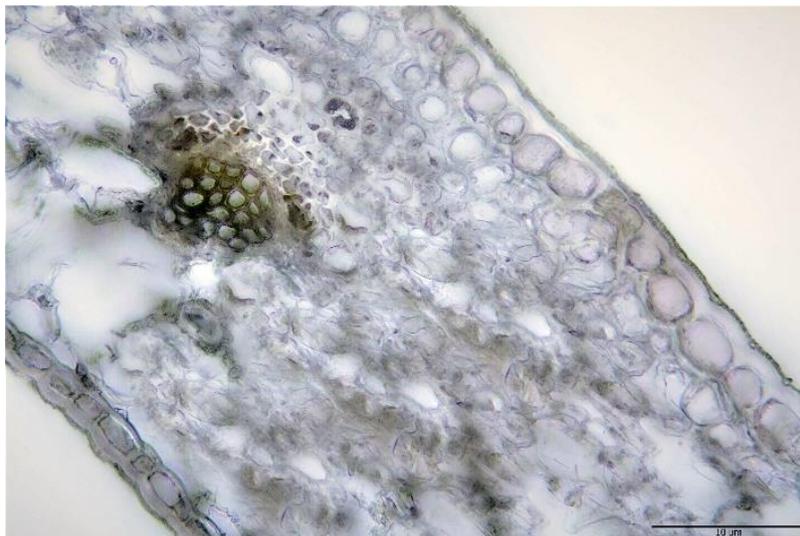


Fig. 4. *E. anacampseros* var. *tmolea* leaf anatomy.

In the cross section of the leaf, the upper epidermis of the leaf consists of two rows of rectangular-round shaped cells while the lower epidermis consists of single rows of rectangular cells. Sclerenchymal fibers are found under the upper epidermis. The conduction bundles are located in the middle of the mesophyll. Sponge parenchyma of the mesophyll tissue is irregular (Fig. 4).

Scanning Electron Microscopy

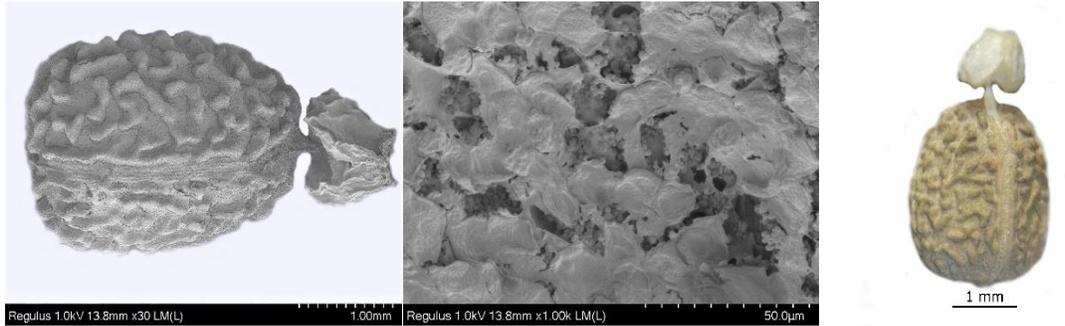


Fig 5. *E. anacampseros* var. *tmolea* seed general view; seed surface; seed.

Seed characteristics are used to determine the boundaries of subspecies, section or subsection groups and species in the genus *Euphorbia*. The presence, absence, shape, seed size, surface decorations of the carunculus in the vicinity of the micropylar region of the seed are important taxonomic characters used to systematically identify and compare species. The seed surface is areolate; the periclinal wall is high and contains fat granules (Fig. 5).

CONCLUSION

In this study, endemic *E. anacampseros* var. *tmolea* root, stem and leaf anatomies were examined in detail. There is no literature information about the characteristics of the anatomical structure of the species therefore we compared with anatomical study on *E. anacampseros* var. *anacampseros* (Gökçen et al. 2018).

Scope of study *E. anacampseros* var. *tmolea* observed morphological features compared with *E. anacampseros* var. *anacampseros* it is as follows *E. anacampseros* var. *tmolea* stems ascending, 30-45 cm; cauline leaves to 40 mm; raylet-leaves to 30 mm broad while *E. anacampseros* var. *anacampseros* stems decumbent, rarely exceeding 20 cm; cauline leaves to 20 mm; raylet-leaves to 17 mm broad.

As a result of the anatomical studies, when the root cross-sections of the species are examined, it is seen that the roots show a secondary root structure. The outermost protective tissue is periderm. The epidermis is crushed just below the periderm layer. Secretory channels are extensively present in the cortex layer of both species. The phloem was placed in a narrow space and the xylem expanded to cover its core.

When the trunk sections are examined, *E. anacampseros* var. *anacampseros* has secretory channels in the cortex parenchyma, while *E. anacampseros* var. *tmolea* is absent. The cortex layers consist of round and rectangular parenchymal cells of various sizes. Transmission packets are open security type. Core zones are empty.

When the leaf sections are examined, cover hairs are seen intensely in with *E. anacampseros* var. *anacampseros* sample and not in *E. anacampseros* var. *tmolea*. In both species, the palisate parenchyma is

located on both sides of the mesophyll tissue. Sponge parenchyma in both species is irregular in the mesophyll layer. The conduction bundles are located in the middle of the mesophyll.

When the result of seed SEM examined *E. anacampseros* var. *tmolea* seed surface is areolate; the periclinal wall is high and contains fat granules.

Morphological and anatomical diagnoses of *E. anacampseros* var. *tmolea* species have been tried to introduce the species better.

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