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Ecological conditions effect on the Anatomical characters of Myrtus communis in Kasnazan, Shameran and Erbil Center in Kurdistan Region of Iraq

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Introduction

Myrtaceae Juss. is a highly prevalent family of angiosperms, commonly referred to as the myrtle family.According to Cronquist (1981) and Heywood (1993), there are around 132 genera and 5,950 species [1] . Approximately 140 genera and from 3,800 to 5,650 species are documented [2], whereas 145 genera and 5,970 species are recorded by [3]. The common Myrtle was characterised by Linnaeus in 1753 and introduced to Britain in [4].

The Myrtaceae is a significant angiosperm family comprising both trees and shrubs, named after the shrub 'Myrtus,' which is located along the Mediterranean in North Africa and South America [2]. The family is distributed in temperate, subtropical, and tropical regions, primarily in Australia and tropical America [5].

The family possesses significant economic significance due to its edible fruits, prevalent in most genera within the subfamily. The Myrtoideae subfamily encompasses Psidium guajava (guava) and Syzygium aqueum (rose apple); essential oils can be extracted from Backhousia citriodora and Eucalyptus species. Numerous species are utilised locally for spices and timber, while several species are farmed for ornamental purposes [1].

Myrtus communis L. is an evergreen shrub predominantly endemic to the Mediterranean region and other Middle Eastern countries, including Jordan, Iraq, and Saudi Arabia [3], [6]. *M. communis* originates from western Asia, northern Africa, and southern Europe. It was distributed throughout Africa (South Africa, Algeria, Ethiopia, Eritrea, Libya, Morocco, Tunisia), Asia (Yemen, Afghanistan, Cyprus, Iraq, Iran, Jordan, Syria, Lebanon, Turkey, Palestine, Pakistan), and Europe (Albania, France, Greece, Portugal, Malta, Spain, Former Yugoslavia) [7]. It contains numerous biologically active compounds that bestow various medicinal properties, including astringent, anti-inflammatory, antiviral, antibacterial, antifungal, antioxidant, antidiabetic, antiulcer, antimutagenic, and gastro- and hepatoprotective effects [8].

The significance of anatomical characteristics in palaeobotanical and taxonomical research. Indicated that leaf anatomical data corroborate morphological evidence for the delineation of Myrtaceae taxa at the generic level [5] . The essential oil derived from the leaves and berries of specific plants, mostly utilised in the industrial production of sweet liquors with digestive attributes [9], [10].

Myrtus communis is extensively dispersed across diverse bioclimatic zones in Iraqi Kurdistan; yet comparative data on its structural adaptation is scarce. This study fills the knowledge vacuum by doing a thorough comparative anatomical analysis of *M. communis* populations collected from three different geographic locations: Kesnazan, Shameran, and Erbil center. The main aim of this research is to assess micro-structural differences in vegetative tissues to ascertain if localised anatomical profiles might function as dependable diagnostic indicators for distinguishing and taxonomically classifying these regional populations.

Materials and methods

-Prepare the sections (Paraffin methods)

Sample specimens were preserved in FAA (Formalin acetic acid alcohol) and subsequently dehydrated with varying alcohol concentrations, after which they were cleansed with xylene for 3 to 4 hours. The material was immersed in a xylene and paraffin mixture for 30 minutes, then transferred to pure paraffin wax and maintained at 60 °C for 24 hours. Subsequently, via a rotary microtome, sections with a thickness of 8–10 µm were produced and immersed in paraffin wax. Subsequently, safranin and fast green were employed to stain the specimens. The slides were ultimately prepared by DPX and examined using Image Analysis Software (ScopeImage 9.0) and a light microscope (Olympus) equipped with a camera [11].

-Prepare the sample to view the Venation

The specimens were obtained from three distinct locations: Kasnazan, Shameran, and Erbil Center. Immerse specimens in 3% NaOH and incubate overnight at 60°C. Subsequently, macerate the samples using safranin for staining. Finally, examine under a light microscope with Image Analysis Software (ScopeImage 9.0) and an Olympus camera [12].

Results

This investigation shows the stems outline of all sample are circular, while the pith shape is different; in *Myrtus communis* (Kasnazan) is triangular, in *Myrtus communis* (Shameran) irregular shaped, but in *Myrtus communis* (Erbil Center) is eye shaped. The tannins, druses or rosette crystals and lysigenous cavity presence in all specimens, the sclerenchyma tissue (stone cells or brachyseclereids) found in *Myrtus communis* (Kasnazan) and *Myrtus communis* (Shameran), and the found in *Myrtus communis* (Kasnazan) and *Myrtus communis* (Erbil Center) (Fig. 1).

The current study revealed the petiole shape are different between the specimens such as in *Myrtus communis* (Kasnazan) the adaxial surface is slightly straight with cup shape in abaxial surface, while in *Myrtus communis* (Shameran) the petiole is semi-elongate in shaped, whereas the adaxial surface is concave with semi-broad shaped in *Myrtus communis* (Erbil Center). All samples contain of the tannins, druses and lysigenous cavity, while only *Myrtus communis* (Erbil Center) present the seclerenchya (stone cells). The trichomes found in *Myrtus communis* (Shameran) and *Myrtus communis* (Erbil Center) are unicellular non-glandular and glandular, and multicellular non-glandular (Fig. 2 and 3).

This work shows the midrib outline is different between the plants samples; in *Myrtus communis* (Kasnazan) the adaxial surface is straight with abaxially V shaped, the adaxial layer of *M. communis* (Shameran) is convex with straight of abaxial layer, while in *M. communis* (Erbil Center) the adaxial view is concave and the abaxial view is little broad with presence the unicellular non-glandullar trichomes. The tannins, druses, seclerenchyma cells and laysigenous cavity found in all specimens (Fig. 4).

This study mentioned the lamia parts of the samples consists of upper and lower epidermis and the mesophyll layer composed of palisade and spongy layers with presence

tannins, druses and lysigenous cavity, and only *Myrtus communis* (Erbil Center) consists of the unicellular non-glandullar trichomes (Fig. 5).

This work reported the presence difference between specimens in outline of margin, in *Myrtus communis* (Kasnazan) is rounded downward, in *Myrtus communis* (Shameran)is rounded straight, while, in *Myrtus communis* (Erbil Center)the margin is pointed downward. In all plans found druses and lysigenous cavity (Fig. 6).

The types of vessels that presence in plants, they are reticulate and pitted as in *Myrtus communis* (Kasnazan), while only reticulated in *Myrtus communis* (Shameran) and *Myrtus communis* (Erbil Center). Also, the leaves venation is reticulate and closed ends (Fig. 7).

The fruits are consisting of three layers exocarp, mesocarp and endocarp with three loculus that is contain the seeds; in *Myrtus communis* (Shameran) they are united, while separate in anthers. *Myrtus communis* (Kasnazan) and *Myrtus communis* (Erbil Center) possess the brachysclereid (Fig. 8).

Discussion

Anatomical features have been utilised as indices in taxonomical studies for over a century. The current work shows the stems are circular, while the arrangement of the vascular bundle is different between specimens, all specimen contain druses, tannins and stone cells and secretory canals. The outline is different between Myrtaceae species such as it is semi-circular as in (*Myrtus*), while quadrangular (*Syzygium*, *Eucalyptus* and *Psidium*), or undulating with presence secretory cavities, druse crystals and tannins [5].

This study revealed the petiole shape are different between the specimens such as adaxial surface is slightly straight with cup shape in abaxial surface, or the petiole is semi-elongate in shaped, and the adaxial surface is concave with semi-broad shaped. All samples contain of the tannins, druses lysigenous cavity and seclerenchya cells. The trichomes are unicellular non-glandular and glandular, and multicellular non-glandular. The petioles exhibited variability in shape and length of Myrtaceae; ranging from elliptic to ovoid to semicircular to winged, and were adorned with simple trichomes. The vascular bundle in a central arrangement within the petiole is characterised by an open arc, the configuration of the vascular system is broad and resembles a U-shape [13].

This subject revealed the midrib outline is different between the plants samples. The midrib anatomy of Myrtaceae generally curved in both directions, supply with one ovate bicollateral vascular. Oil lumen located near to both surfaces and unicellular trichomes also druses crystals are present [5].

Myrtle is a delightful annual shrub characterised by dark blue ripe berries, which have a longstanding utilisation in the perfume, cosmetic, food, and medicinal sectors. Furthermore, these berries are extensively utilised in the commercial formulation of sweet liquor. Research indicates that seeds of *M. communis* var. italica may serve as a significant source of antioxidants alongside bioactive chemicals, especially polyphenols. There is a growing interest in utilising naturally occurring antioxidants in food, cosmetic, and pharmaceutical goods as substitutes for manufactured antioxidants, which are associated with carcinogenic consequences [14].

This plant has recently been identified the oil canal present in all parts of the plant samples, this is also appointed by [15], [16].

Conclusion

This study concluded that *Myrtus communis* (Kasnazan), *Myrtus communis* (Shameran) and *Myrtus communis* (Erbil Center) exhibit variation in the anatomical characteristics of the stem, petiole, midrib, lamina, leaf margin and fruits.

Acknowledgement

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Data available declaration

No datasets were generated or analyzed during the current study.

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Contributions

Chnar Najmaddin Fathulla: Writing, review and editing. Rasty Abdullah Muhammad: Methodology administration, and take the photos. Serwan Taha Al-dabbagh: collection and identify the plants, with review.

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Declarations

Ethics approval and consent to participate

This study was conducted under approval by the plant ethics committee at the Salahaddin University (2025). Verbal and written consent was provided by parents and agreement for publication was obtained from both participants and researchers.

Consent for publication

Not applicable.

Permits for collecting plants/plant parts

Plant material was obtained from districts where no statement of need for permits or licenses was required.

Consent to publication

Not applicable. The manuscript does not contain any individual person's data in any form.

Competing interest

The authors declare no competing interests.

Clinical trial number

Not applicable.

Samples information

1. All plant parts used in the study are wild plants, and the plant name complies with local or national guidelines. No permits or licenses are required for their collection and study.
2. Ethics of plant use
   The plant material used in this study is of wild origin, and the plants were collected in their growing environments during the flowering and fruiting season.
   A. The scientific name was identified by co-author Serwan Taha Al-Dabbagh, specializing in plant taxonomy and anatomy.
   B. Herbarium Details:
      The herbarium specimens were deposited in the herbarium of the College of Science, Salahaddin University, Erbil (ARB), after being labeled, numbered and having complete information about the plants' histories recorded.
   C. A table of collected wild plants and voucher specimen(s) of the wild plants collected was stored in the herbarium where they were stored.

Voucher Number	Scientific name (Family)	Common names (Kurdish) English	Location and elevation
*ARB; 7635	Myrtus communis L. (Myrtaceae)	Common myrtle or true myrtle (E); Murtk (K)	Kasnazan, north of Erbil; Alt: 716 m.
ARB; 7636	Myrtus communis L. (Myrtaceae)	Common myrtle or true myrtle (E); Murtk (K)	Shameran, South of Sulaymaniyah; Alt: 316 m.
ARB; 7636	Myrtus communis L. (Myrtaceae)	Common myrtle or true myrtle (E); Murtk (K)	Erbil, City center; Alt: 420 m.

*ARB; Herbarium of: College of Science, Salahaddin University-Erbil / Erbil, Iraq

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Figures Caption

Fig. 1 CS of Stem a. *Myrtus communis* (Kasnazan), d. *Myrtus communis* (Shameran), f. *Myrtus communis* (Erbil Center). b,c. magnified of (a), e. magnified (D), g. magnified (f). pe: periderm, ph: phloem, x: xylem, pi: pith, ls: lysigenous cavity, d: druse crystal, ta: tannins, sc: stone cell. (a, d, f = 4X. b, c, e, g = 40X).

Fig. 2 CS of Petiole a. *Myrtus communis* (Kasnazan), c. *Myrtus communis* (Shameran), e. *Myrtus communis* (Erbil Center), b. magnified (a), d. magnified (c), f. magnified (e). vb = vascular bundle, ls = lysigenous cavity, d = druse crystal, ta = tannins, tr = trichrome, cu = cuticle, e = epidermis, sc = stone cell. (a, c, e = 4X. b, d & f = 40X).

Fig. 3 CS of Petiole a. *Myrtus communis* (Kasnazan), c. *Myrtus communis* (Shameran), e. *Myrtus communis* (Erbil Center), (g, h): magnified (c). (i, j): magnified (e). mt = multicellular trichrome (non-glandular), ut = unicellular trichrome (non-glandular), utg = unicellular trichrome (glandular), ls = lysigenous cavity, d = druse crystal, ta = tannins, cu = cuticle, e = epidermis, sc = stone cell. (g, h, i, j = 40X).

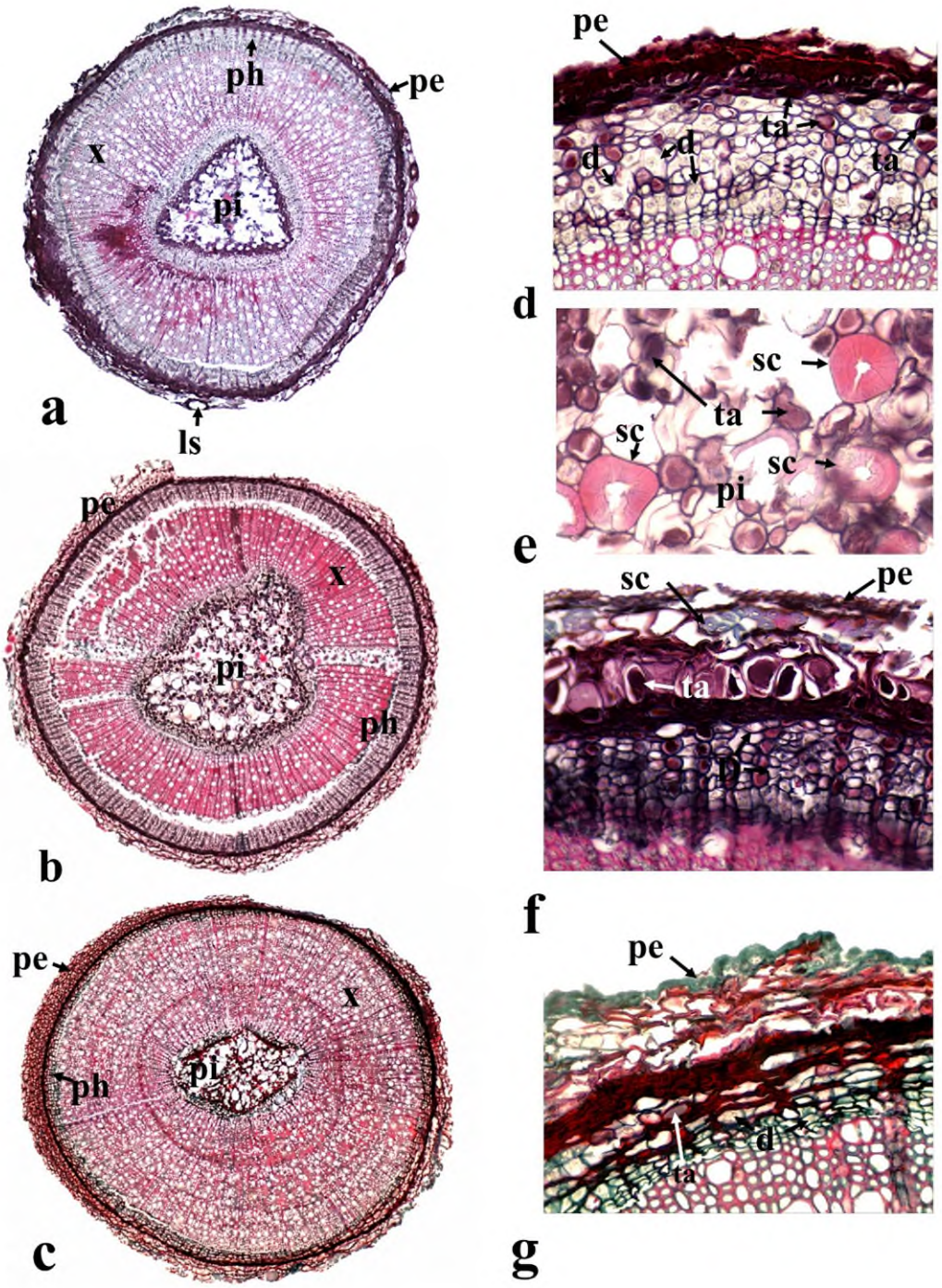
Fig. 4 CS of Leave a. *Myrtus communis* (Kasnazan), c. *Myrtus communis* (Shameran), e. *Myrtus communis* (Erbil Center), (b): magnified (a). (d): magnified (c). (f, g): magnified (e). ue = upper epidermis, le = lower epidermis, pa = palisade layer, sp = spongy layer, vb = vascular bundle, ls = lysigenous cavity, d = druse crystal, ta = tannins, cu = cuticle, ut = unicellular-trichrome. (a, c, e = 10X. b, d, f & g = 40X).

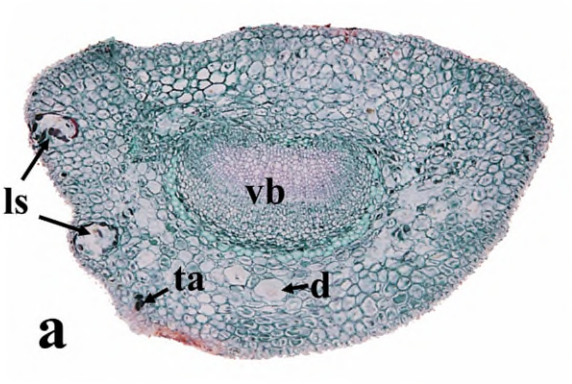
Fig. 5 CS of Lamina a. *Myrtus communis* (Kasnazan), b. *Myrtus communis* (Shameran), c. *Myrtus communis* (Erbil Center), (d, e): magnified (c). ue = upper epidermis, le = lower epidermis, pa = palisade layer, sp = spongy layer, vb = vascular bundle, ls = lysigenous cavity, d = druse crystal, ta = tannins, cu = cuticle, ut = unicellular- trichrome. (a, b, c = 10X. d, e = 40X).

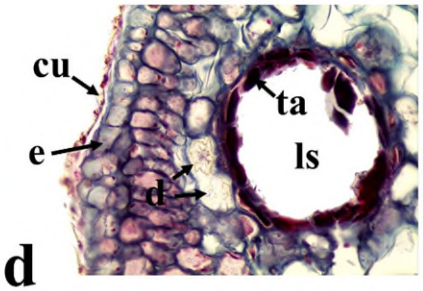
Fig. 6 CS of Margin a. *Myrtus communis* (Kasnazan), b. *Myrtus communis* (Shameran), c. *Myrtus communis* (Erbil Center), ue = upper epidermis, le = lower epidermis, pa = palisade layer, sp = spongy layer, ls = lysigenous cavity, d = druse crystal, ta = tannins, cu = cuticle. (a, b, c = 10X).

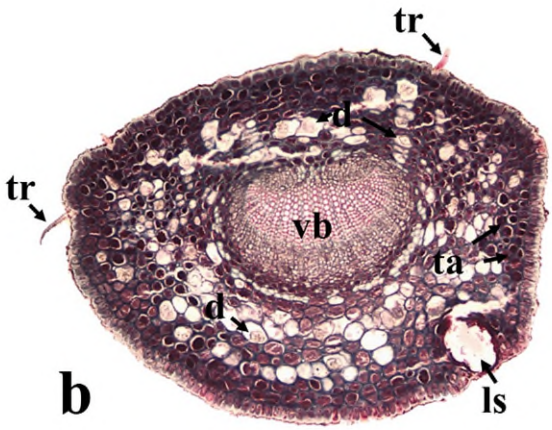
Fig. 7 Vessels and Venation a,b. *Myrtus communis* (Kasnazan), c,d. *Myrtus communis* (Shameran), e,f. *Myrtus communis* (Erbil Center), fi = fiber, pt = pitted, re = reticulate. (a, b, c, d, e, f = 40X).

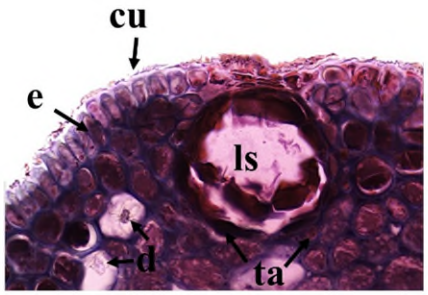
Fig. 8 Fruits a. *Myrtus communis* (Kasnazan), c. *Myrtus communis* (Shameran), e. *Myrtus communis* (Erbil Center), (b): magnified (a). (d): magnified (c). (f): magnified (e). ex = exocarp, en = endocarp, me = mesocarp, se = seed, vb = vascular bundle, ta = tannins, ls = lysigenous cavity, d = druse crystal, sc = stone cell. (a, c, e = 10X. b, d, f = 40X).

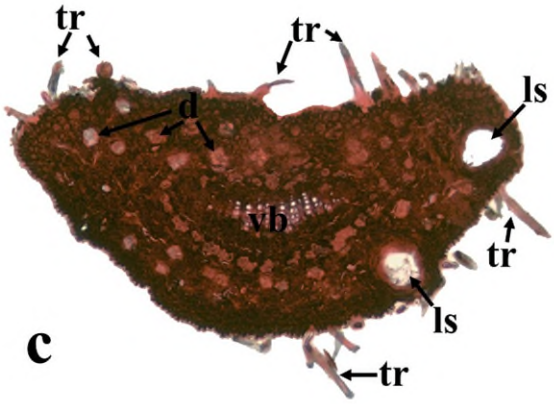

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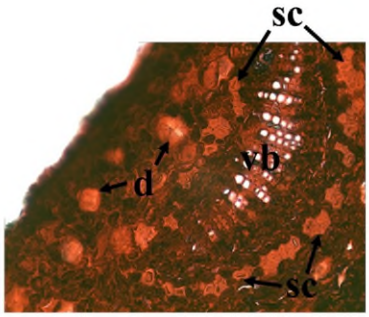

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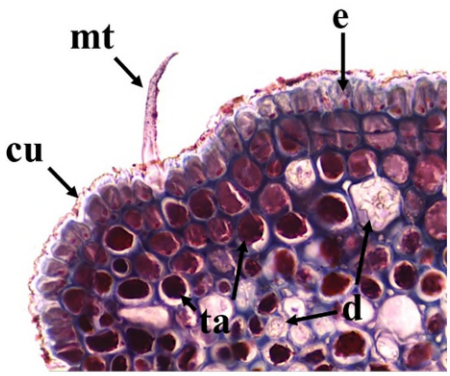

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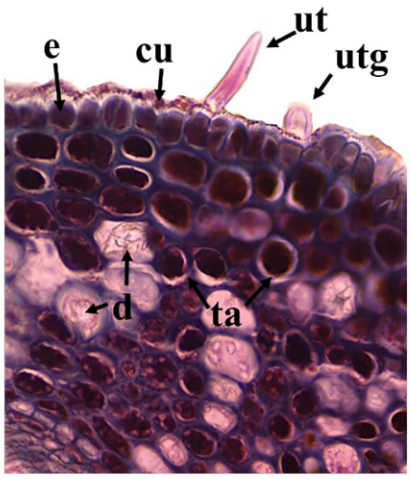

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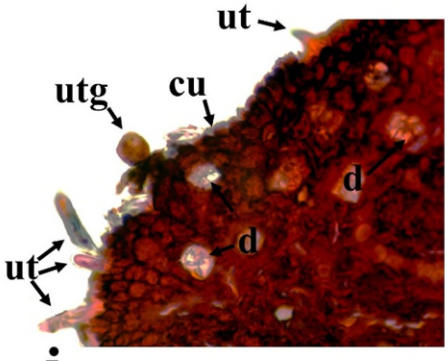

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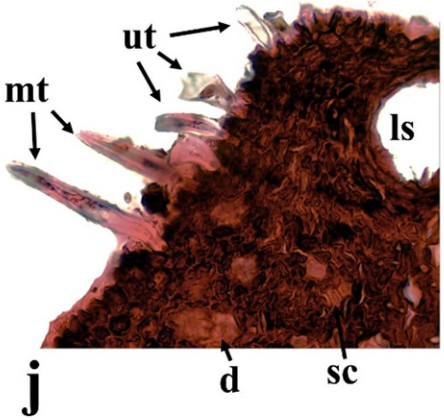
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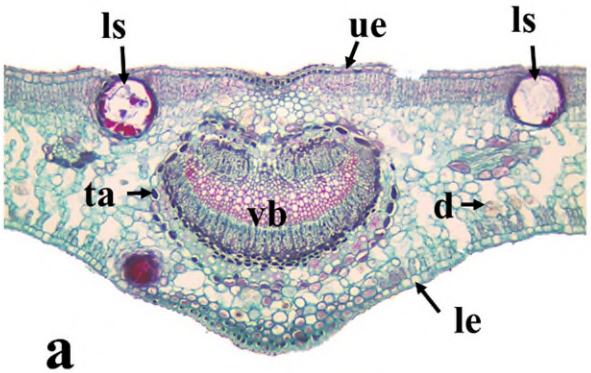
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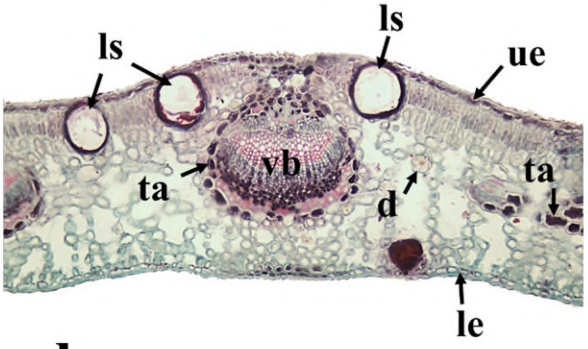
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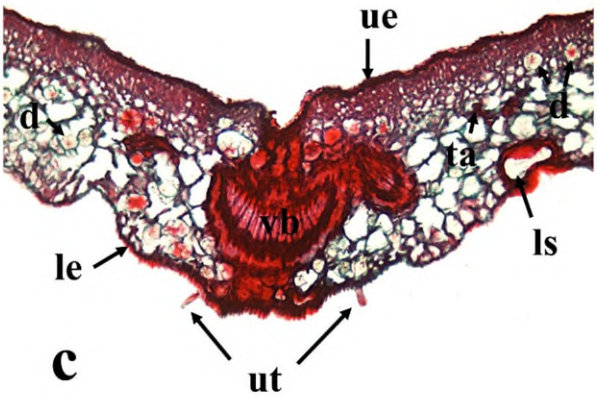
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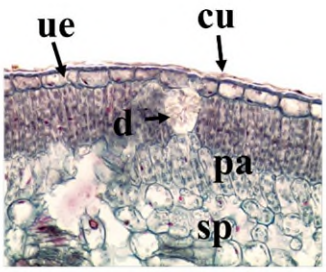
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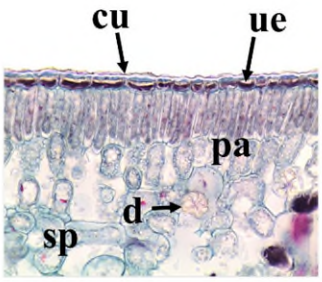
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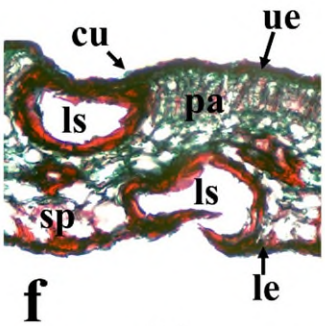
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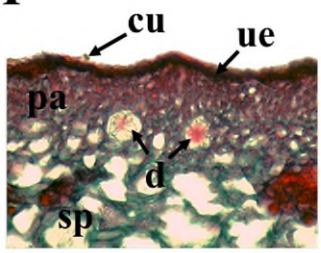
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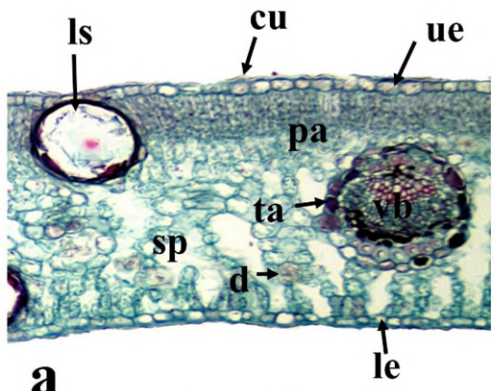
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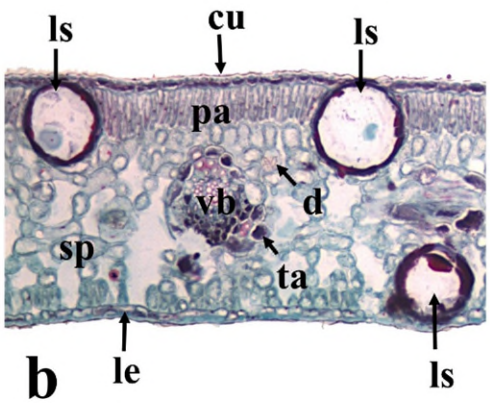
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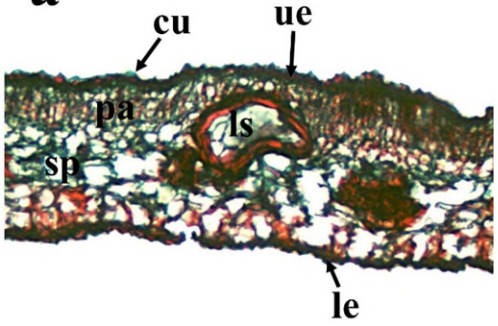
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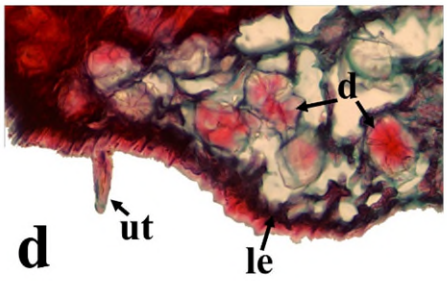
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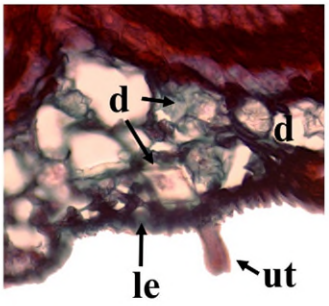
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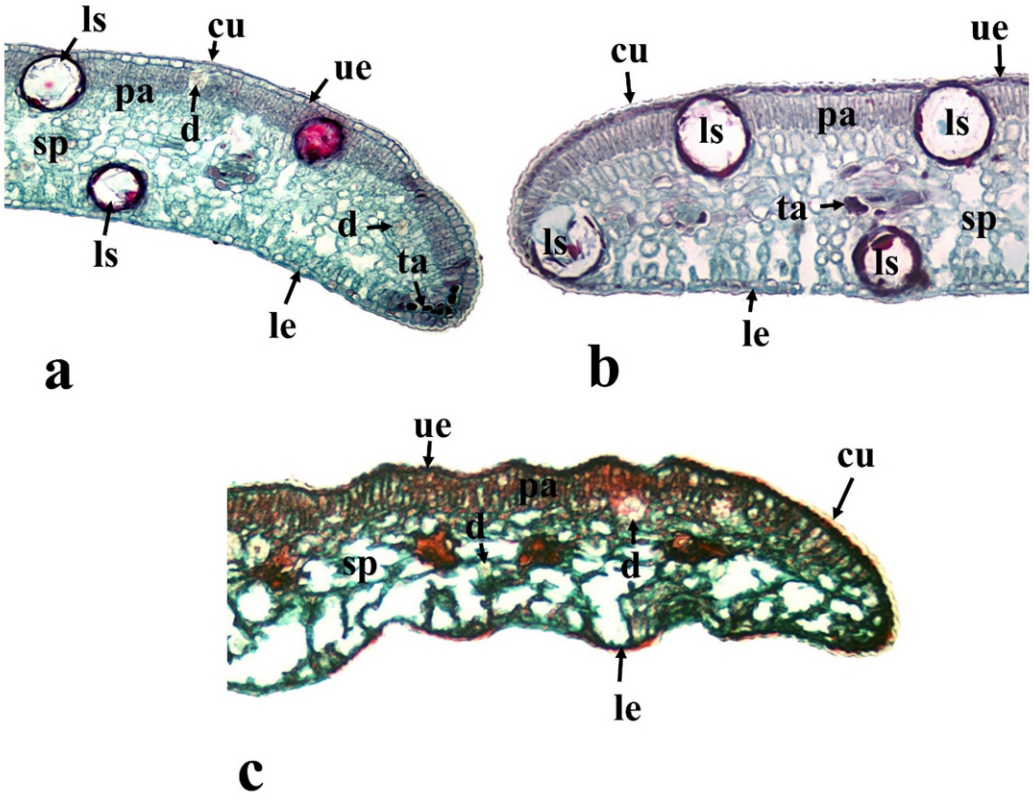
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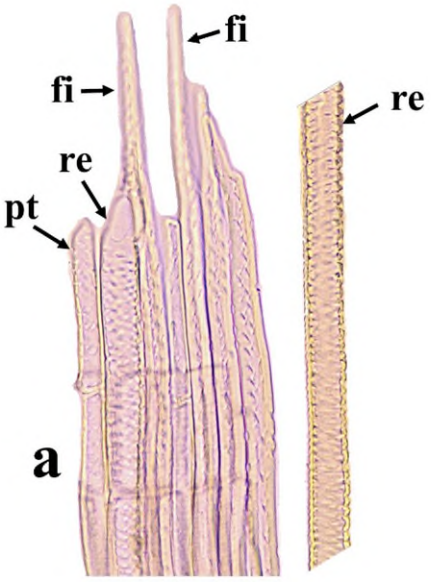

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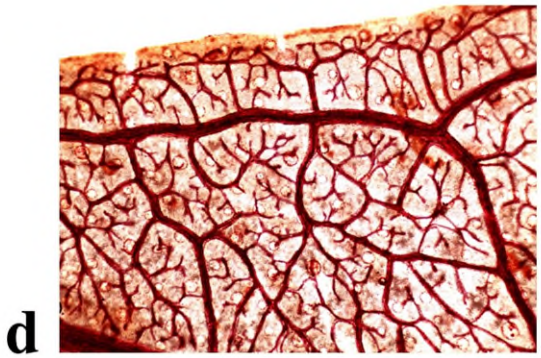
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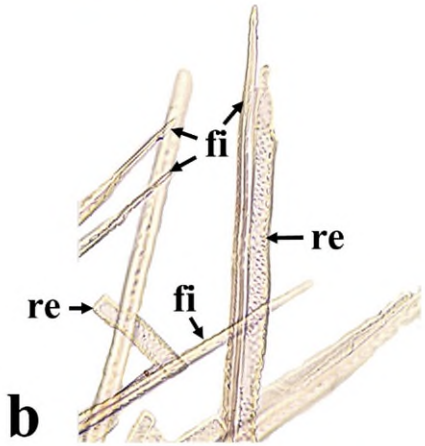

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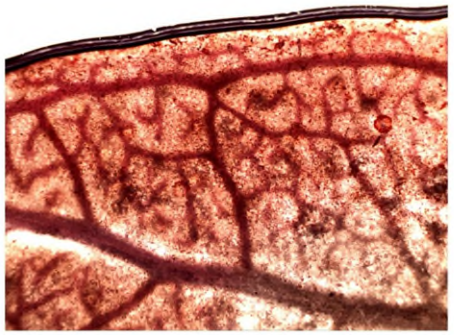
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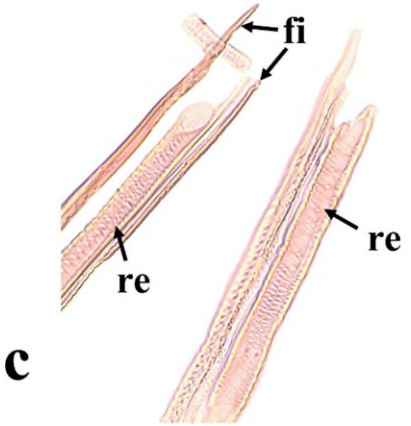

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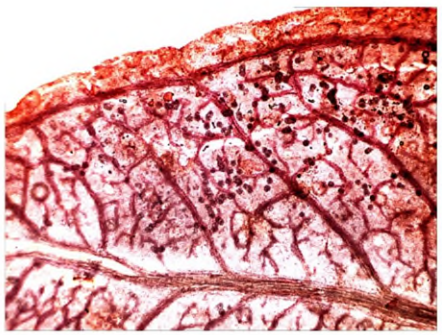

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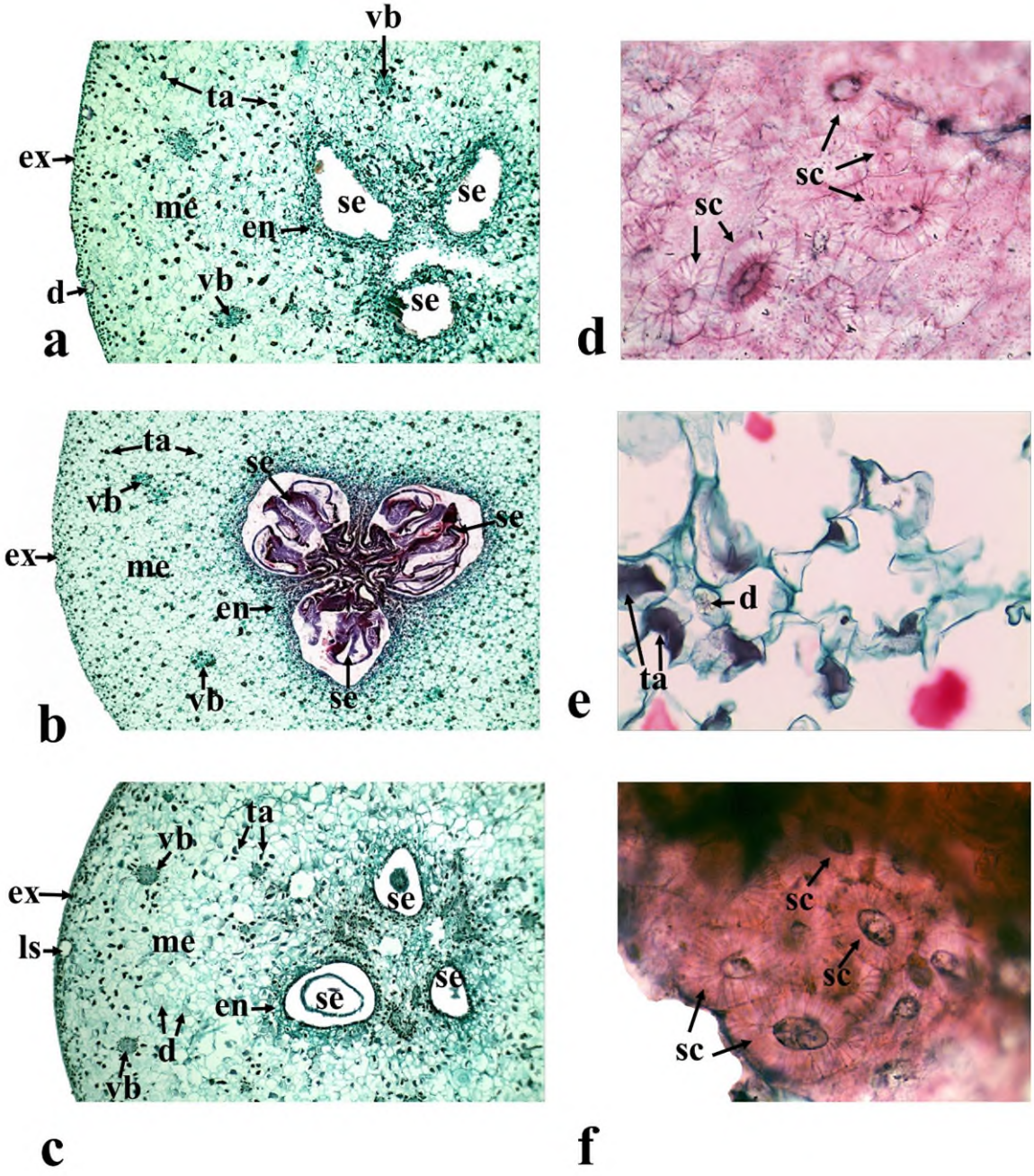

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