

COMPARATIVE ANATOMY OF THE VEGETATIVE ORGANS OF THE *HEDERA HELIX* L. (ARALIACEAE)

ELENA SĂVULESCU, VASILICA LUCHIAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest

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Abstract

The research made on the anatomy of the Hedera helix vegetative organs have highlighted some features characteristic of the epidermis, collenchymas and assimilator tissue of the leaves and fertile and sterile stems.

A thick cuticle covers the epidermis. Following the felogen activity, the epidermis is broken at the sterile stems comparative with the fertile stems. Tectorial multi-cell hairs are in the epidermis of both stem types.

The cortex is multi-layered and it can be differentiated in two zones: external and internal cortex. The external cortex has done by the 4-5 collenchymatous cell layers with calcium oxalate crystals in numerous cells. The internal cortex has done by 5-7 cell layers with thin walls and many secretive ducts close to the pericycle.

In the central cylinder were found 20-35 vascular bundles from open collateral type, with phloem outside and xylem inside.

The medulla made up of isodiametric cells with thin walls.

The leaves are hypostomatic type with tectorial hairs and the mesophyll is bifacial. Into the mesophyll are vascular bundles of collateral type with the xylem outside and phloem inside. In some cells of mesophyll leaves are crystals of calcium oxalate and secretive ducts into the median nervure.

INTRODUCTION

Hedera helix L. (Ivy) is from *Araliaceae* family (*Apiales, Magnoliopsida, Magnoliophytina, Spermatophyta* [1]).

Ivy is a liana with adventives fixing roots with two stem types: fertile and sterile.

Leaves are alternate, dimorphe, palmate-lobed at the sterile stems and ovate with smooth margins at the fertile leaves. In all organs of plant are secretive ducts [3].

Ivy have certain anatomical features depending on the growing conditions [4] such as the type cells of the palisadic tissue or secretive ducts [2]. The ivy is ornamental and medicinal plant and some time it is an invasive species.

MATERIAL AND METHODS

Studies were conducted on leaves and stems of *Hedera helix* from the Botanical Garden of USAMV Bucharest during 2007-2008.

Transversal sections were provided in the leaves and fertile and sterile stems from young plants.

Sections have been clarified, according to the classical method, using the chlorine hydrate, for 24 hours and after that they were wash and colored with carmine alaanate and green iodine. After coloring, the sections were washed and fixed in glycerine gelatine.

The measurements and photos were made at the optical microscope MC-7 (ob. 40, oc. 10).

RESULTS AND DISCUSSION

Anatomy of stem

Comparing the anatomy of both stems (fertile and sterile), three zones were observed: epidermis, cortex and central cylinder.

Epidermis is formed by only one cells row with thin walls and average thickness of 11 μm , covered externally by a thick wax layer with about 7 μm (figure 1). In the epidermis were observed multi-cells tectorials hairs.

In sterile stems are areas where the epidermis is broken as a result of coming into activity of the felogen, which generate the secondary suber outer and feloderma inside (secondary cortex), unlike the fertile stems (figure 2).

The multi-layered cortex presents an average thickness of 381 μm at the fertile stem and 261 μm at the sterile stem. It is composed by outer and inner cortex. The outer cortex is composed of 4-5 collenchymatous cell rows with thickening walls. In some cells can be observed chloroplasts, others contain crystals of calcium oxalate (ursini). The inner cortex is composed of 5-7 rows of cells with thin walls. Close to the central cylinder were observed numerous secretive ducts with polygonal lumen, delimited by secretive cells.

The central cylinder is delimited by a fragmented sclerenchymatous pericycle at outer witch generate the adventives roots. The vascular bundles are collateral open type with phloem outside and xylem inside. Between the both vascular bundles type is the interfascicular cambium. Between phloem bundles is expanded parenchyma. Between the xylem bundles are the primary medullar radii. The phloem bundles have an average thickness of 165 μm to fertile stems and an average of 57 μm at sterile stems. The xylem bundles have a thickness of 283 μm at fertile stems and 114 μm at sterile stems protected by the sclerenchymatous rings, consisting of 2-4 rows of cells. The medullar zone has an average thickness

of 1450 μm and is composed by the isodiametric cells with thin walls and with crystals of calcium oxalate into the cells.

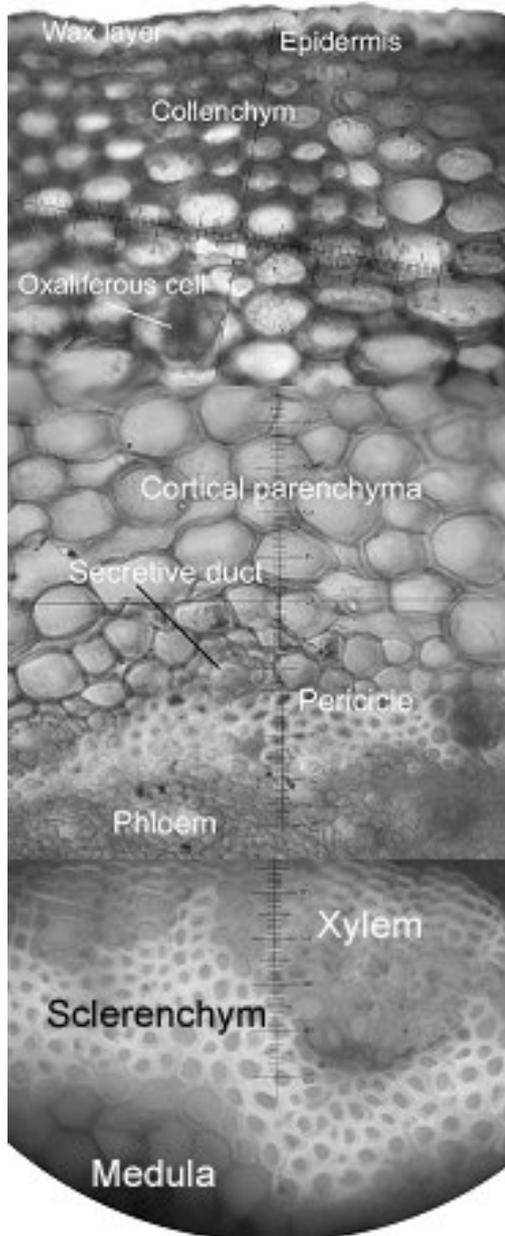


Fig. 1. Transversal section on the *Hedera helix* fertile stem

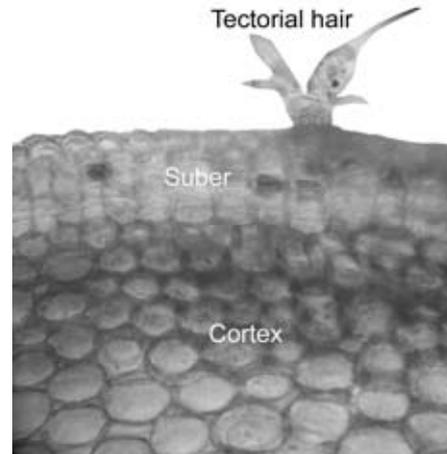


Fig. 2. Transversal section on the *Hedera helix* sterile stem

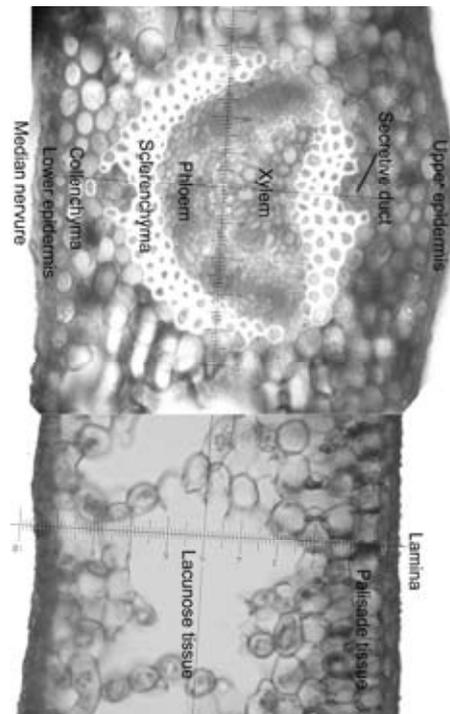


Fig. 3. Transversal section on the *Hedera helix* leaf

Anatomy of leaf

There are not any anatomical differences between leaves from fertile and sterile stems. Epidermis is made up of only one cells layer with polygonal cells with thin lateral walls and corrugated. The thickness average of epidermis is 11 μm and a thick wax layer with about 4 μm covers it. In the lower epidermis were observed tectorial hairs and stomata (figure 3). The leaves are hypostomatic type.

Leaves mesophyll have had values ranging from 258 μm at the leaves of fertile stems and 243 μm at the leaves of sterile stems. Leaf mesophyll is bifacial type with palisade tissue under upper epidermis, consisting of 2 layers with isodiametric cells and high content of chloroplasts. Lacunose tissue with large lacunae consisting of 5-6 layers of ovoid cells with lower content of chloroplasts there is under lower epidermis. In the mesophyll were observed collateral vascular bundles type with outer xylem and inner phloem and numerous cells with calcium oxalate. In median nervure of leaf is a great collateral vascular bundle in the form of arc, with outer xylem and inner phloem, covered by a sclerenchymatous tissue. Under the epidermis is the tabular collenchyma with two small opposite secretive ducts.

CONCLUSIONS

1. A thick wax layer covers epidermis of stem.
2. The phelogen generate the secondary suber only at the sterile stem.
3. The both types of stems have tectorial hairs.
4. There are not any structural differences between the leaves of the both stem types.
5. The palisade tissue is formed by the isodiametric cells not with prosenchymatic cells as usual it is.
6. In the cortex stems and mesophyll leaves are present crystals of calcium oxalate.
7. In stems and leaves are present secretive ducts.

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