



Anatomical Study of Petiole and Leaf Parts of *Gossypium Hirsutum* L. in Erbil / Iraq

Chnar N. Fathulla^{1,*} Bahar J. Mahmood²

¹Department of Biology /Collage of Science/Salahaddin University/Erbil/Iraq

²Department of Crop product/Collage of Agriculture/Salahaddin University/Erbil/Iraq

Article's Information

Received: 05.06.2023
Accepted: 05.09.2023
Published: 15.09.2023

Keywords:

Anatomy of Malvaceae
Leaf anatomy of *Gossypium*
Morphology of *Gossypium*
Distribution

Abstract

The plant *Gossypium Hirsutum* genotypes were grown in Qwshtapa district, Grdmala village, which is 30 kilometres from the centre of Erbil, Iraq. The cotton genotypes grown there included Coker 310, Lachata (Iraqi genotypes), Cafko, Dunn 1047, Montana, Stone Ville (USA genotypes), Bakhtegon, Khordora, and Vanamin (Iranian genotypes). The anatomical investigation demonstrates distinct petioles, midribs, laminas, and margin outline shapes among the genotypes. They contain secretory tissues, cluster crystals, and tannins. While some genotypes lack the trichomes, others have; these genotypes are multicellular glandular and unicellular branching or unbranched non-glandula.

DOI: 10.22401/ANJS.26.3.05

*Corresponding author: chnar.fathulla@su.edu.krd



This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

1. Introduction

Malvaceae includes more than 1000 species that are divided into 80 genera. Its distribution is essentially ecumenical and it is most strongly represented in sunny, outdoor habitats in warm temperate and seasonally dry tropical regions. It is made up of herbs, shrubs, and trees that are erect or decumbent and have stellate hairs and mucilage [1]. Simple, lobed, or split leaves are present, along with lower, single or clustered flowers. The epicalyx, which has five sepals and petals as well as an excessive number of stamens, is a useful trait for identifying distinct species. In rare cases, the fruit is a berry and is a loculicidal dehiscent, indehiscent capsule, or schizocarp. While the seeds are reniform or ovoid and have a great economic value, Hibiscus sabdriffa and sida stem fibres are used to make cordage, ropes, sacks, and papers [2]. The fibres from the seeds of *Gossypium* spp. (cotton), a perennial dicotyledon in the Malvaceae family is utilized in textile and rubber tire materials [2]. The structure of cotton fibres at various phases of development and their significant commercial relevance have been thoroughly investigated [3]. The aim of this work is

to study the anatomical differences among the *Gossypium* genotypes.

2. Materials and Methods

2.2. Plant collection

Plant materials of *Gossypium hirsutum* genotypes (Coker 310, Lachata (Iraqi genotypes), Cafko, Dunn 1047, Montana, Stone Ville (USA genotypes), Bakhtegon, Khordora, Vanamin (Iranian genotypes) were collected from Qwshtapa district, Grdmala village, which is 30 km far from the center of Erbil city, and fixed in fixative (FAA) that the prepare by mixing of formalin 5ml, Glacial acetic acid 5ml and ethyl alcohol 90ml (70%).

2.3. Plant Sections' Preparation

Pieces of the samples were placed in the FAA, dehydrated using a succession of alcohol concentrations, cleaned with xylene, injected with paraffin wax, and then left at 60°C overnight. After that, sections were created using a rotary microtome and embedded in paraffin wax. Afterwards, safranin and light green were used to dye the sections. Finally, the sections were examined under the microscope using DPX Mount [4].

3. Results and Discussion

Since the invention of the microscope, systematic anatomy has had a lengthy history, and taxonomists are now able to identify anatomical similarities across related plant groups. Plant taxonomy and systematics always viewed anatomical qualities as the cornerstone of plant structure and morphology, elucidating the diversity, phylogeny, and evolution of plants in the wake of these traits. Anatomical information is used for identification and to correct classification schemas. Systematics involving stem, leaf, petiole, stipule, node, flower, fruit, seed, etc. makes extensive use of anatomical data. These anatomical characteristics are primarily associated with environmental variables. It is advantageous to define the taxon with a wide range of morphological differences since the character's anatomy of the plant is more important than morphological data [5]. The trichomes, stomata, and other characteristics of the leaf anatomy are helpful anatomical tools [6]. Each genotype has four strands. In Coker310, Lachata, Cafko, and Bakhtegon, the trichomes are multicellular glandular, but in Montana, Stoneville, Khdorda, and Vanamin, the trichomes are both multicellular glandular and unicellular branching non-glandular. Only Lachata has starch grains, while the other genotypes all have aleurone grains, tannins, druses crystals, and lysigenous cavities (secretory canals) (Figure 1, 2, 3). Most members of the Malvaceae family have six vascular bundle threads and show secretory tissues in the cortex, according to [7].

According to this study, genotype midribs varied in shape. For example, the adaxial surface of the Coker310 midrib is short and humped, while the abaxial surface is rounded. In contrast, the adaxial surface of the Lachata and Cafko midrib is humped and the abaxial surface is U-shaped. The adaxial surface is curved, whereas the abaxial surface is rounded, as in Montana, and the abaxial surface is cup-shaped, like in Dunn 1047. The abaxial surface is cup-shaped, like in Stoneville, while the adaxial is lengthy and heavily humped. While the adaxial surface in Bakhtegon and Khdorda is humped, the abaxial surface is broad and rounded. While the adaxial surface in Bakhtegon and Khdorda is humped, the abaxial surface is broadly rounded. Last but not least, the adaxial surface of Vanamin (Iranian genotypes) is

curved and the abaxial surface is V-shaped. The tannins, secretory cells, and druse crystals are present in all genotypes. In Coker310, Lachata, and Bakhtegon, the hairs are absent. In Cafko and Montana, the hairs are unicellular branched non-glandular, in Stoneville, Khdorda, and Vanamin, the hairs are multicellular glandular, and in Dunn1047, the hairs are both multicellular glandular and unicellular branched non-glandular. The tannins and rosette crystals are found in all genotypes (Figure 4, 5). While the adaxial surface in Bakhtegon and Khdorda is humped, the abaxial surface is broadly rounded. Last but not least, the adaxial surface of Vanamin (Iranian genotypes) is curved and the abaxial surface is V-shaped. The tannins, secretory cells, and druse crystals are present in all genotypes. In Coker310, Lachata, and Bakhtegon, the hairs are absent. In Cafko and Montana, the hairs are unicellular branched non-glandular, in Stoneville, Khdorda, and Vanamin (Iranian genotypes), the hairs are multicellular glandular, and in Dunn1047, the hairs are both multicellular glandular and unicellular branched non-glandular [8,7,3].

This study showed that the lamina genotypes are made up of the mesophyll layer, palisade layer, and upper epidermis layer. These layers contain vascular cylinders, cluster crystals, tannins, and lysigenous canals (secretory canals). In Montana and Khdorda, the furs are multicellular glandular; in Cafko, it is unicellular branching non-glandular; in Dunn1047, Stoneville, Bakhtegon, and Vanamin, it is both unicellular non-glandular and multicellular glandular; and in Coker310 and Lachata, the hairs are nonexistent (Figure 6, 7). [5,8,2,3] pointed out that the leaf anatomy is often dorsiventral, with the mesophyll layer containing a large number of cluster or rosette crystals and the dorsal layer made of elongated cells called palisade cells. Present the multicellular glands and non-glandular unicellular organisms with sharp apices hairs. The margin between genotypes with rounded ends and those with rounded or pointed ends. As in Lachata and Vanamin, the furs are multicellular glandular; as in Cafko, Montana, and Khdorda; or as in Dunn1047, the hairs are unicellular non-glandular non-branched; and as in Coker310, Stoneville, and Bakhtegon, the hairs are absent (Figure 8, 9).

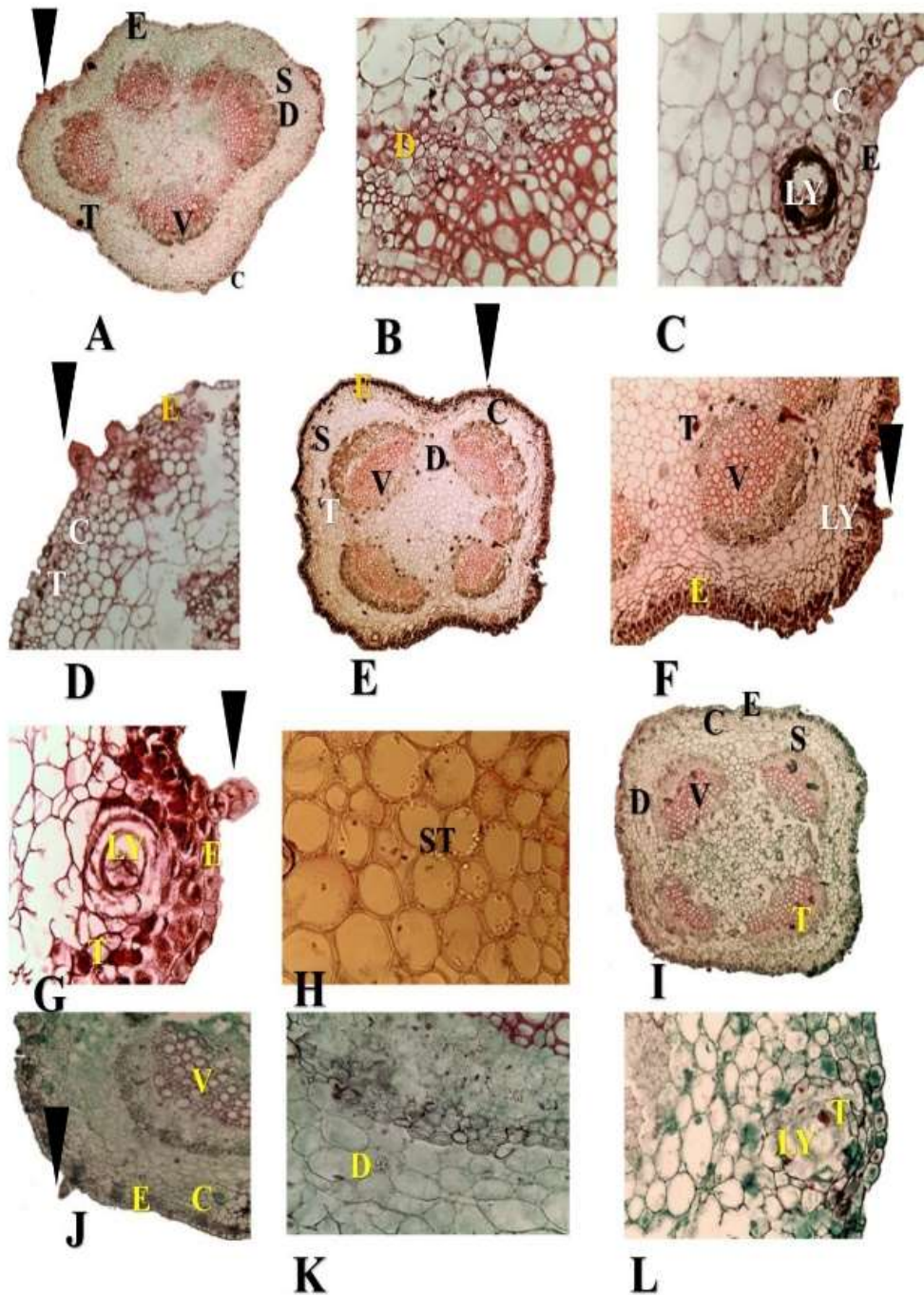


Figure1. T.S petiole sections of *Gossypium hirsutum* genotypes: A. Coker310, B,C,D. magnification power of A, E. Lachata, F,G,H. magnification power of E, I. Cafko, J,K,L. magnification power of I. C:collenchyma, E: epidermis, S: secretory canal, D: druses, V: vascular bundle, T: tannins, ST: starch grains, LY: lysigenous cavities, trichomes (black arrow). A,E,I=4X, B,C,D,F,G,H,J,K,L=40X

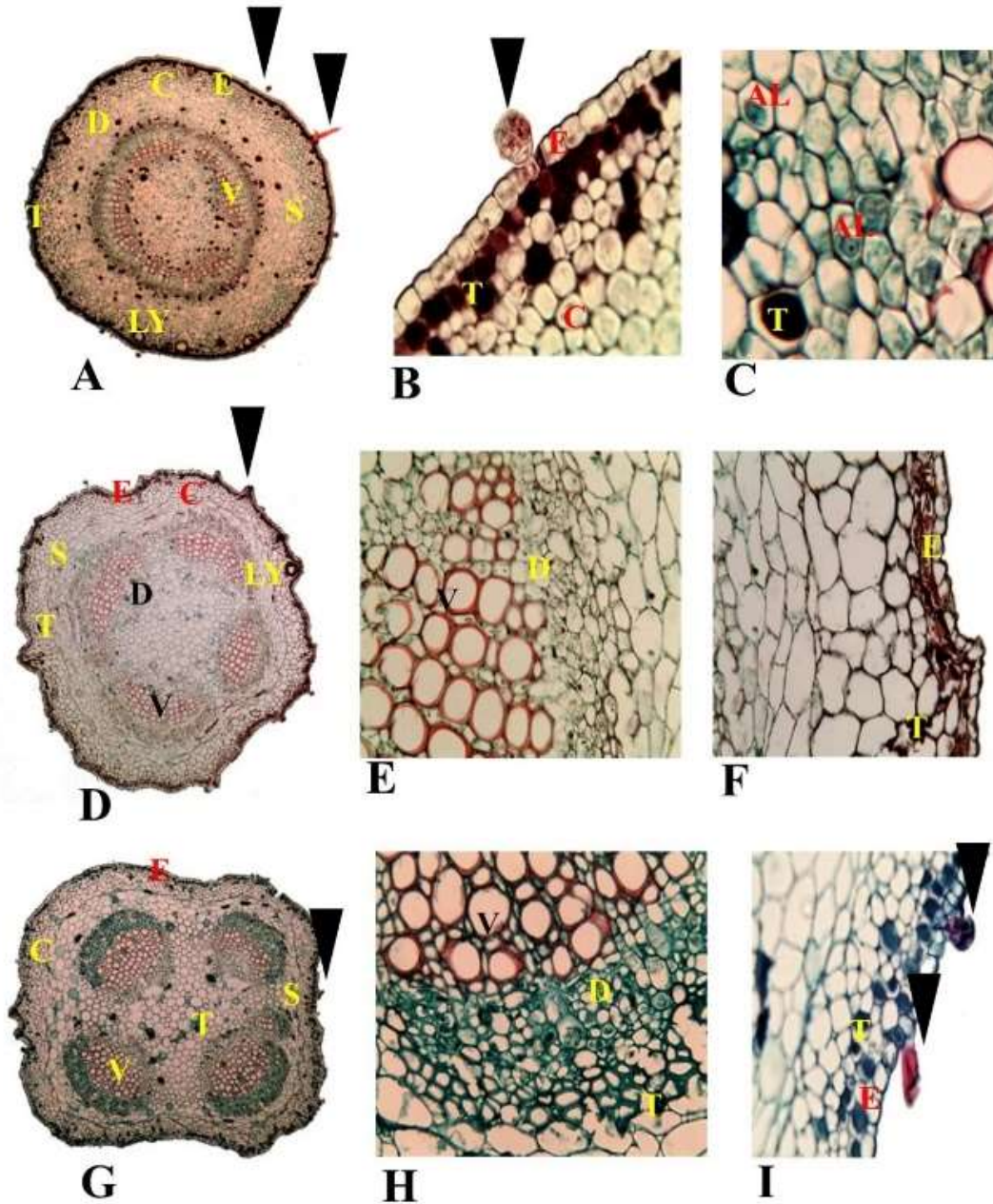


Figure2. T.S petiole sections of *Gossypium hirsutum* genotypes: A. Dunn1047, B,C. magnification power of A, D. Montana, E,F. magnification power of D, G. Stone ville, H,I. magnification power of G. C:collenchyma, E: epidermis, S: secretory canal, D: druses, V: vascular bundle, T: tannins, AL. aleurone grains, LY: lysigenoous cavities, trichomes (black arrow). A,E,I=4X, B,C,D,F,G,H=40X

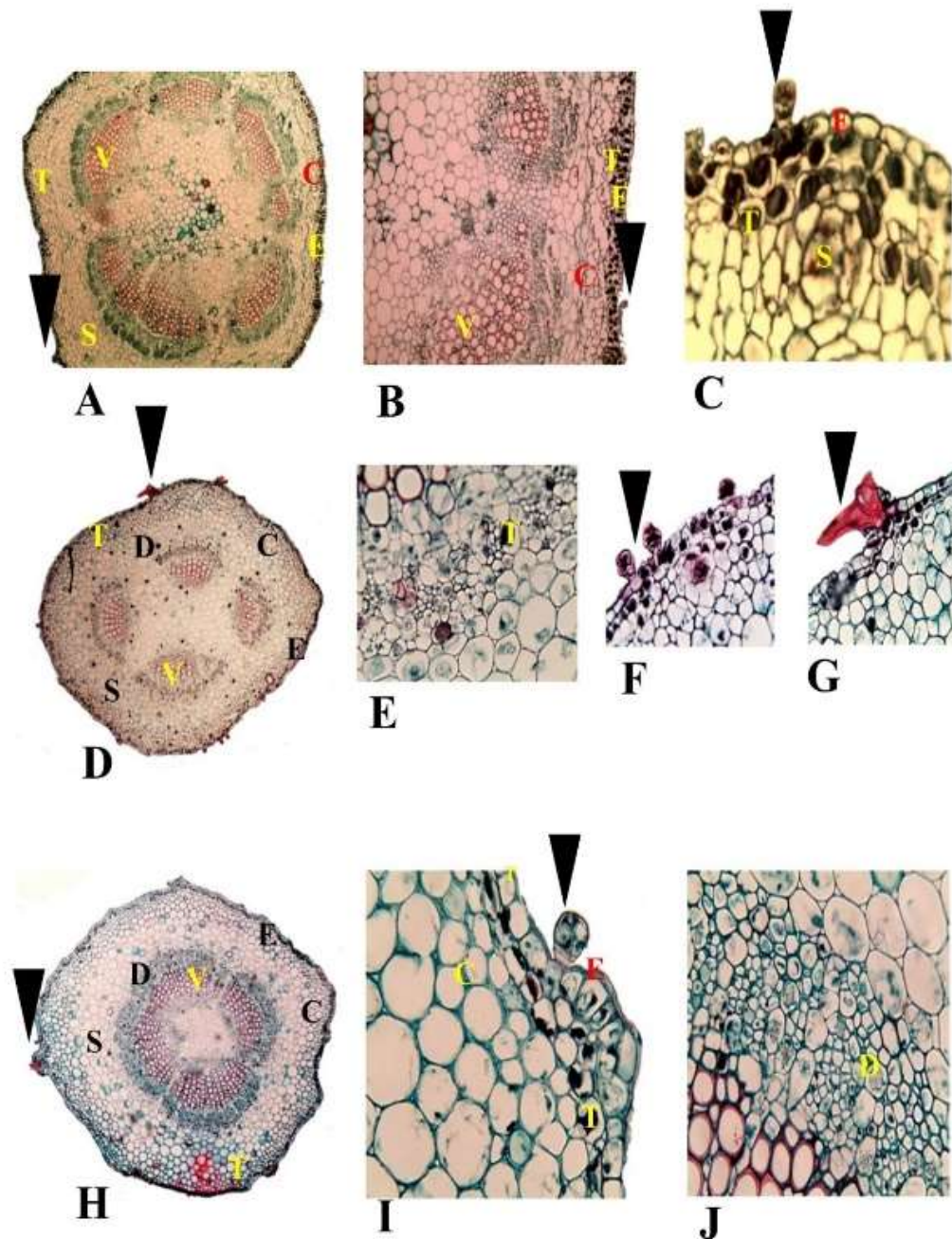


Figure3. T.S petiole sections of *Gossypium hirsutum* genotypes: A. Bakhtegon, B,C. magnification power of A, D. Khdorda, E,F,G. magnification power of D, H. Vanamin, I,J. magnification power of H. C:collenchyma, E: epidermis, S: secretory canal, D: druses, V: vascular bundle, T: tannins, trichomes (black arrow). A,D,H=4X, B,C,E,F,G,I,J=40X

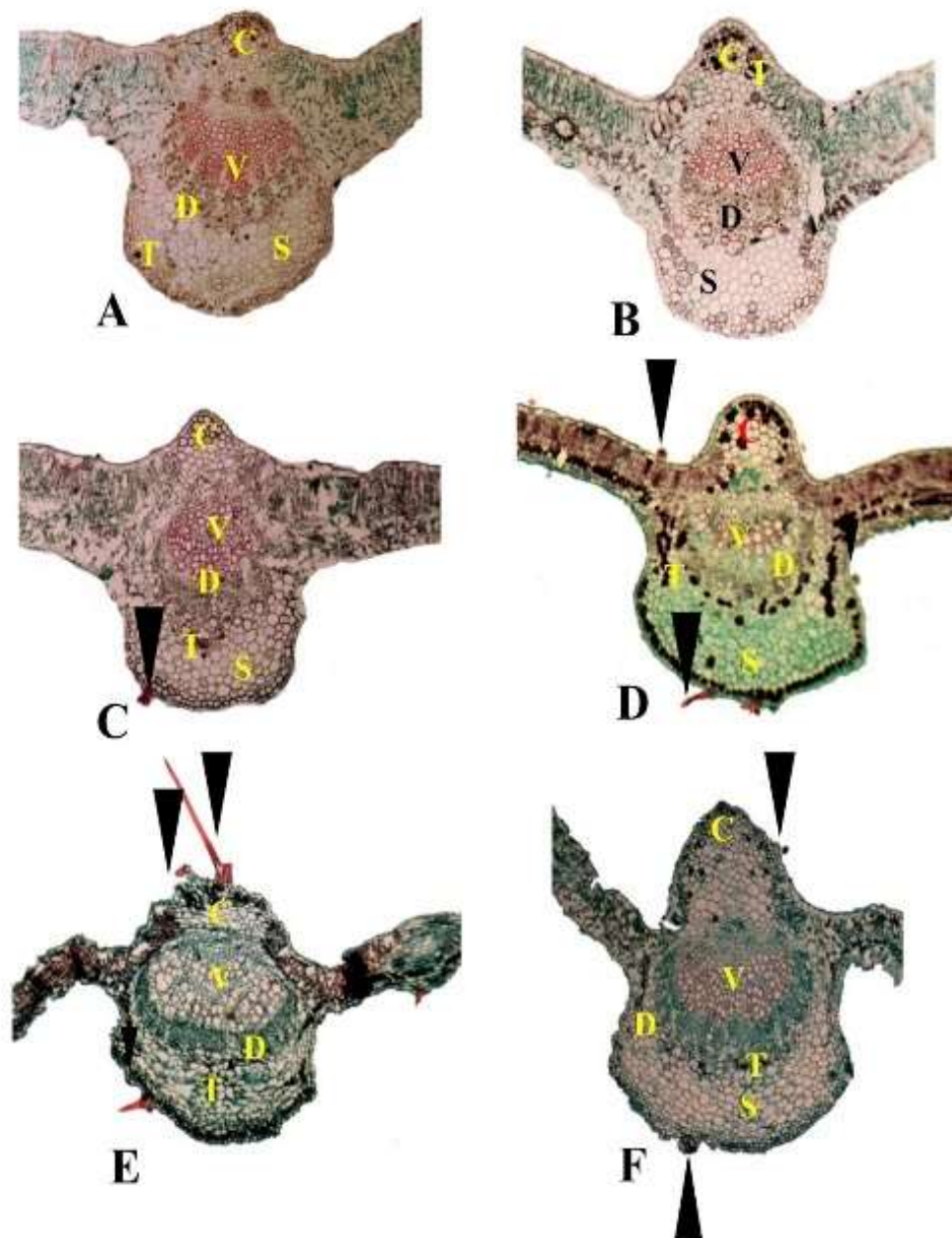


Figure4. T.S midrib sections of *Gossypium hirsutum* genotypes: A. Coker310, B. Lachata, C. Cafko, D. Dunn1047, E. Montana. F. Stone ville. C: collenchyma, S: secretory canal, D: druses, V: vascular bundle, T: tannins, trichomes (black arrow). A,B,C,D,E,F=4X.

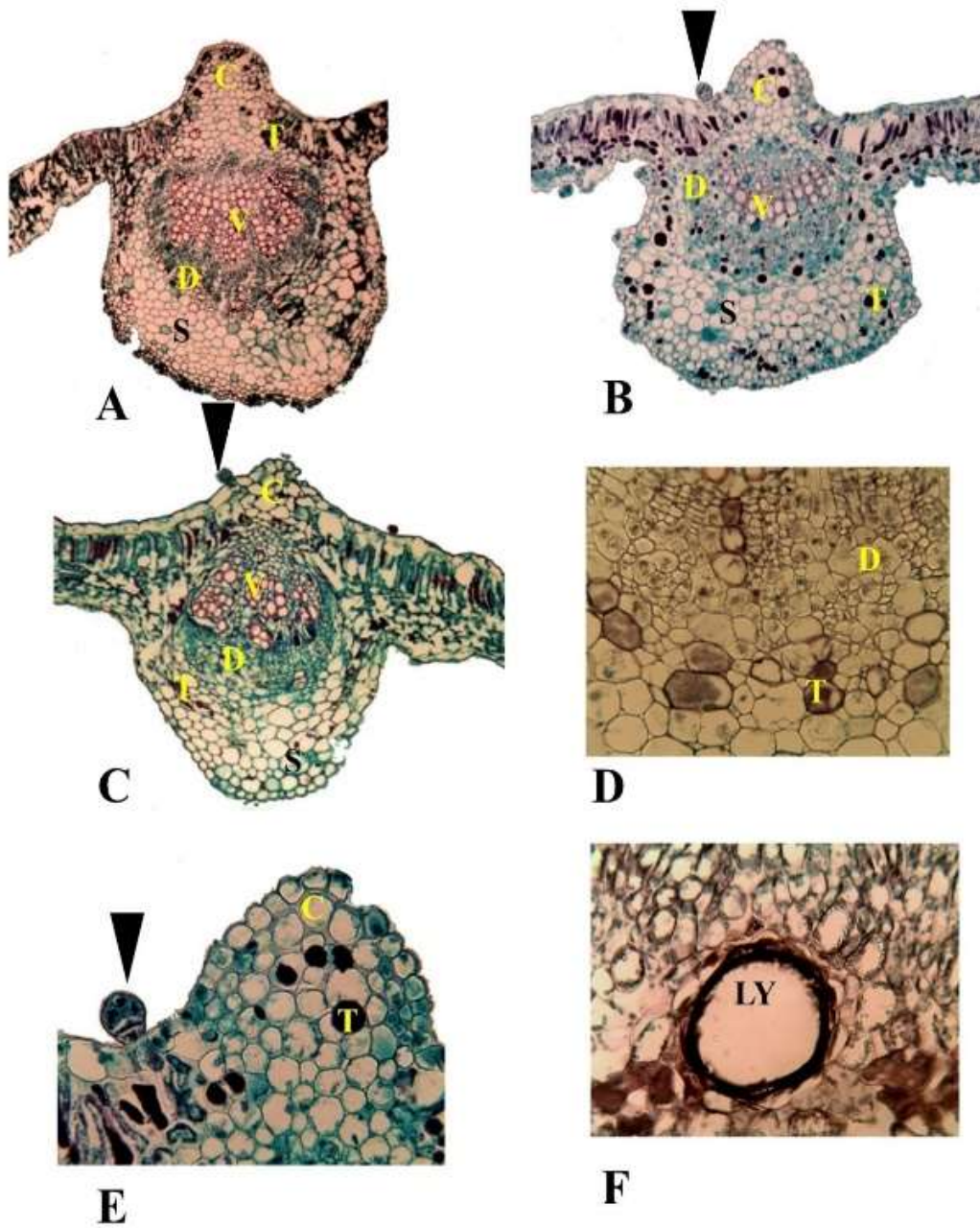


Figure5. T.S midrib sections of *Gossypium hirsutum* genotypes: A. Bakhtegon, B. Khdorda, C. Vanamin, D,E,F. magnification power of midribs. C: collenchyma, S: secretory canal, D: druses, V: vascular bundle, T: tannins, LY: lysigenous cavities, trichomes (black arrow). A,B,C=4X, D,E,F=40X.

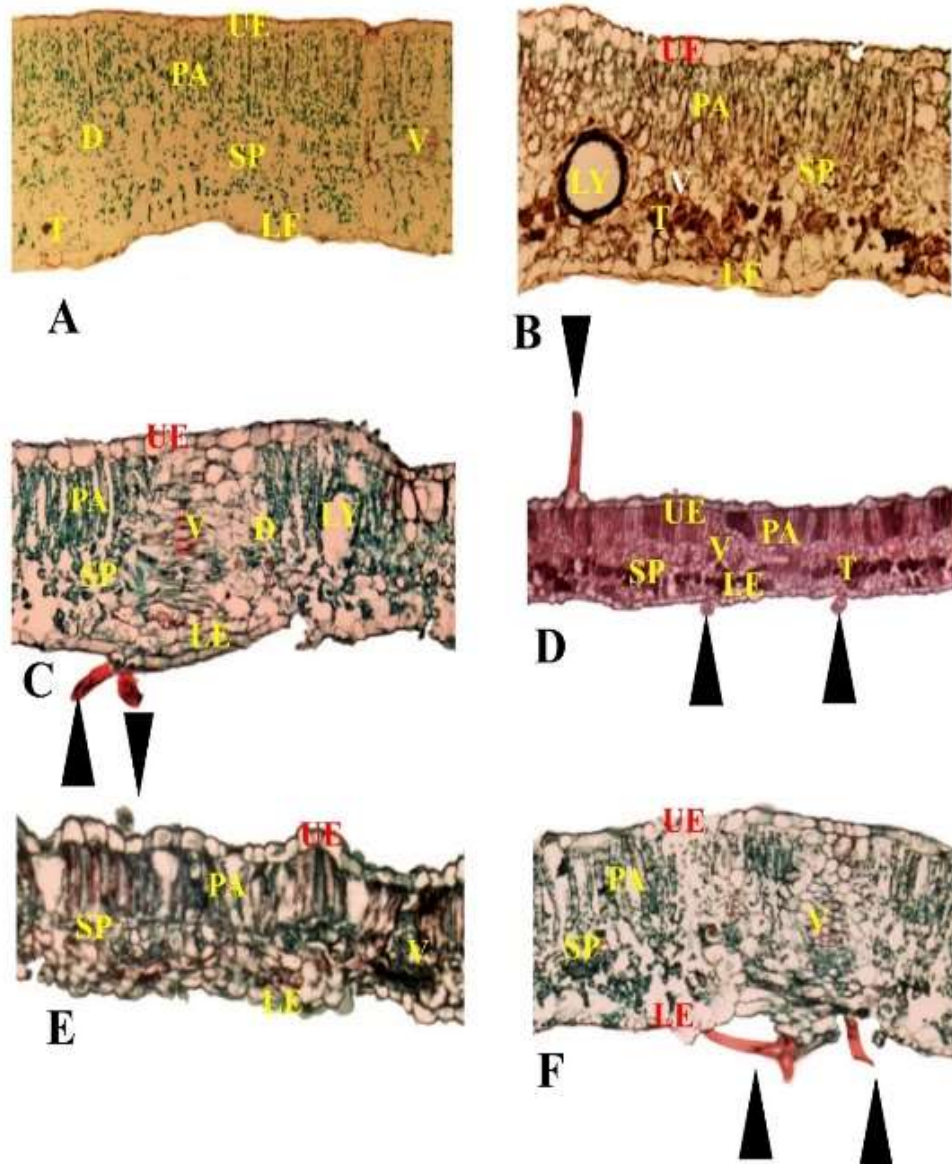


Figure6. T.S lamina sections of *Gossypium hirsutum* genotypes: A. Coker310, B. Lachata, C. Cafko, D. Dunn1047, E. Montana, F. Stone ville. S: secretory canal, D: druses, V: vascular bundle, T: tannins, UE: upper epidermis, LE: lower epidermis, PA: palisade layer, SP: spongy layer, LY: lysigenous cavities, trichomes (black arrow). A,B,C,D,E,F=10X.

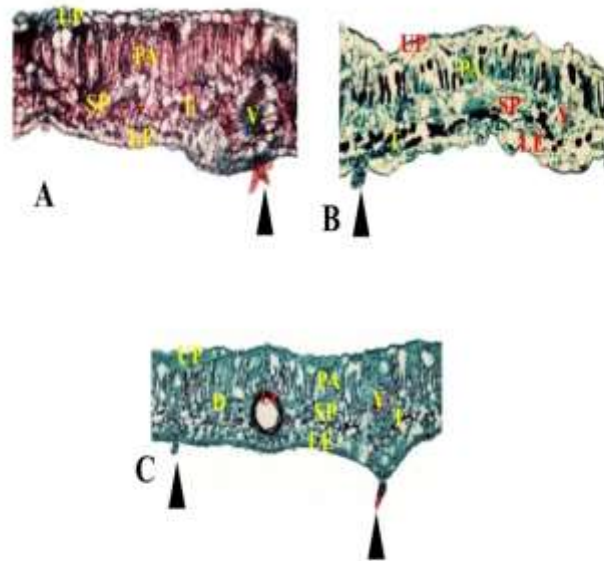


Figure7. T.S lamina sections of *Gossypium hirsutum* genotypes: A. Bakhtegon, B. Khdor-da, C. Vanamin. S: secretory canal, D: druses, V: vascular bundle, T: tannins, UE: upper epidermis, LE: lower epidermis, PA: palisade layer, SP: spongy layer, LY: lysigenoecus cavities, trichomes (black arrow). A,B,C=10X.

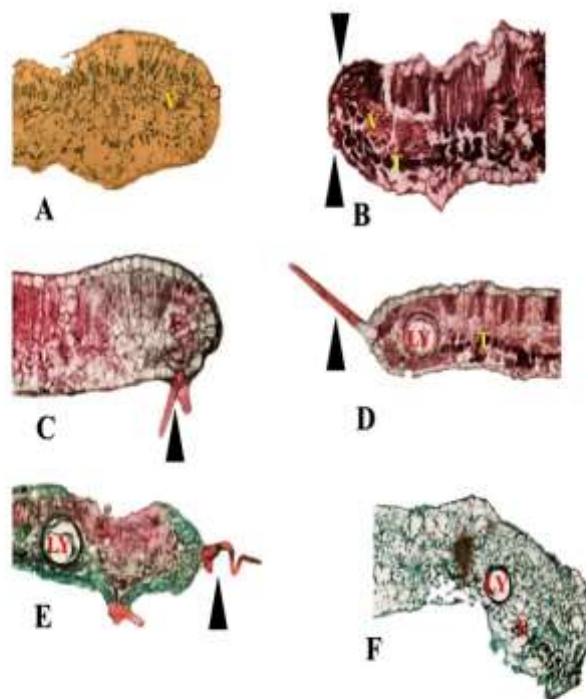


Figure8. T.S margin sections of *Gossypium hirsutum* genotypes: A. Coker310, B. Lachata, C. Cafko, D. Dunn1047, E. Montana, F. Stone ville. LY: lysigenoecus cavities, V: vascular bundle, T: tannins, trichomes (black arrow). A,B,C,D,E,F=10X.

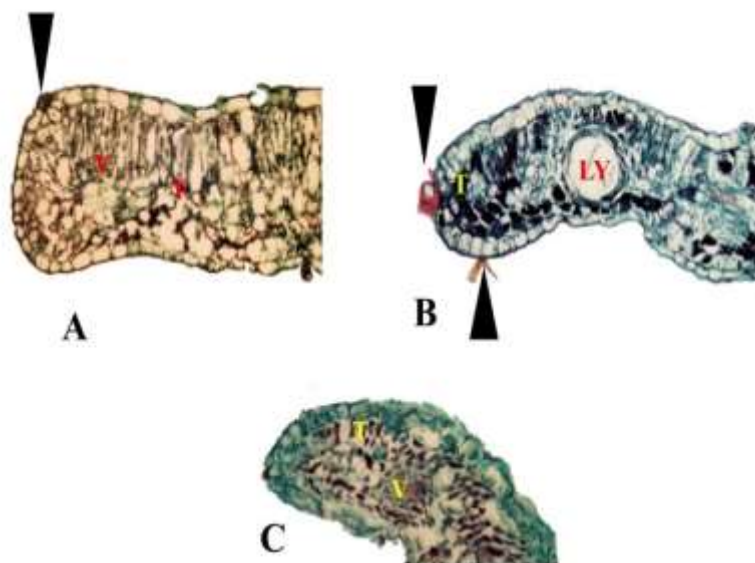


Figure9. T.S section of *Gossypium hirsutum* genotypes: A. Bakhtegon, B. Khdor-da, C. Vanamin. LY: lysigenous cavities, V: vascular bundle, T: tannins, trichomes (black arrow), A,B,C=10X.

4. Conclusions

This investigation concluded that *Gossypium hirsutum* genotypes differ in the outline shape of the petiole, midrib, and margin. The druses crystals, lysigenous cavity and tannins are present in the all taken parts in this work. The starch grains are found only in the petiole of genotype Lachata. All genotypes petiole contains aleurone grains. Trichomes are presented which are multicellular glandular or unicellular branched non-glandular.

Acknowledgements: The authors would like to acknowledge the logistical support provided by Salahaddin University and the opportunity to conduct the research work in its laboratories.

Conflicts of Interest:

The authors declare no conflicts of interest for this work.

References

- [1] Ozkan, A.M.G.; Uzunhisarcikli M.E.; "Stem and leaf anatomy of *Althaea* L. (Malvaceae) Species Growing in Turkey". Hacettepe University Journal of Faculty of Pharmacy 28(2): 133-148, 2009.
- [2] Said, W.M.; Mohamed, T.R.; Elhalwagi, A.A.; Ahmed, Z.M.; "Morphological and Anatomical Studies on Some Taxa of Sub Family Malvoideae (Malvaceae s.I)". J. Sci. Res. Sci. 35: 345-357, 2018.
- [3] Webber, I.E.; "Anatomy of the leaf and stem of *Gossypium*". J. Agr. Res. 57(4): 269-286, 1938.
- [4] Najmaddin, C.; A "Comparative study of anatomical epidermis and palynological *Lagerstroemia Indica* cultivars". J. Int. Pharm. Res. 46(4): 368-372, 2019.
- [5] Naskar, S.; "Anatomical studies of some common members of malvaceae *S.S.* from west Bengal". Ind. J. Plant Sci. 5: 1-7, 2016.
- [6] Ahmad, K.; Khan, M.A.; Ahmad, M.; Shaheen, N. and Nazir, A.; "Taxonomic diversity in epidermal cells of some sub-tropical plant species". Int. J. Agr. Bio. Eng. 12: 115-118, 2010.
- [7] Metcalfe, C.R.; Chalk, L.; "Anatomy of the dicotyledons". Vol. II. London, Oxford University Press, 1950.
- [8] Guvenc, A.; Ozkan, A.M.; Erdurak, C.S.; Coskun, M.; "Root, stem and leaf anatomy of *Abutilon theophrastii* Medik. (Malvaceae)". Pak J. Bot. 35(3): 351-359, 2003.