EURASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES
Innovative Academy Research Support Center
IF = 9.2 www.in-academy.uz/index.php/ejmns

ANATOMICAL AND DIAGNOSTIC FEATURES OF THE VEGETATIVE ORGANS (INFLORESCENCE AXIS, STEM, AND ROOT) OF *SALVIA OFFICINALIS* L.

Normakhamatov Nodirali Sokhobatalievich[1]
Toshtemirova Charos Toshtemirovna[1]
Duschanova Guljan Madrimbaevna[2]
Turaboev Abdulkhamid Abduvokhid o'g'li[1]
Yakubov Shokhzodbek Uktamboy ugli[1]
[1]Tashkent pharmaceutical institute,
e-mail: lidernamchem@mail.ru
[2]Tashkent State Pedagogical University named after Nizami
https://doi.org/10.5281/zenodo.20594374

ARTICLE INFO

Received: 02nd June 2026
Accepted: 07th June 2026
Online: 08th June 2026

KEYWORDS

Salvia officinalis, anatomical structure, inflorescence axis, stem, root, trichome, periderm, vascular bundle, medicinal plant.

ABSTRACT

This study investigated the anatomical structure of the inflorescence axis, stem, and root of Salvia officinalis L. The results made it possible to identify the morpho-anatomical features and diagnostic characteristics of these organs. The inflorescence axis was found to be quadrangular in cross-section and characterized by the presence of glandular trichomes in the epidermis. The stem exhibited well-developed secondary conducting tissues and a non-bundled structure. The root showed a strongly lignified structure, with a well-developed periderm and central cylinder. The obtained results are important for the identification of plant raw materials and pharmacognostic analyses.

In recent years, extensive scientific and practical work has been carried out in the Republic of Uzbekistan on the rational use, cultivation, and processing of medicinal plants. The rapid development of the pharmaceutical industry has significantly increased the demand for medicinal plant raw materials.

The anatomical structure of the inflorescence axis of Salvia officinalis L. was found to be quadrangular and angular in cross-section and belonged to the non-bundled type. The outer surface is covered with a single-layer epidermis consisting of oval cells. Both simple and multicellular glandular trichomes, including capitate and spherical types, were observed.

The peripheral quadrangular region of the inflorescence axis contains 9–10 layers of angular collenchyma cells. The primary cortex parenchyma consists of 8–9 layers of rounded-oval cells, three of which contain chlorophyll grains. These parenchyma cells persist during vegetation, accumulate biologically active substances, and essential oils are secreted through glandular trichomes. Bast fibers were observed between the cortex parenchyma and libriform tissue.

The central cylinder forms the major part of the inflorescence axis and consists of primary and secondary conducting tissues. Its central region is composed of

thin-walled rounded-oval parenchyma cells, among which hydrocytic cells are present. (Figure 1.)

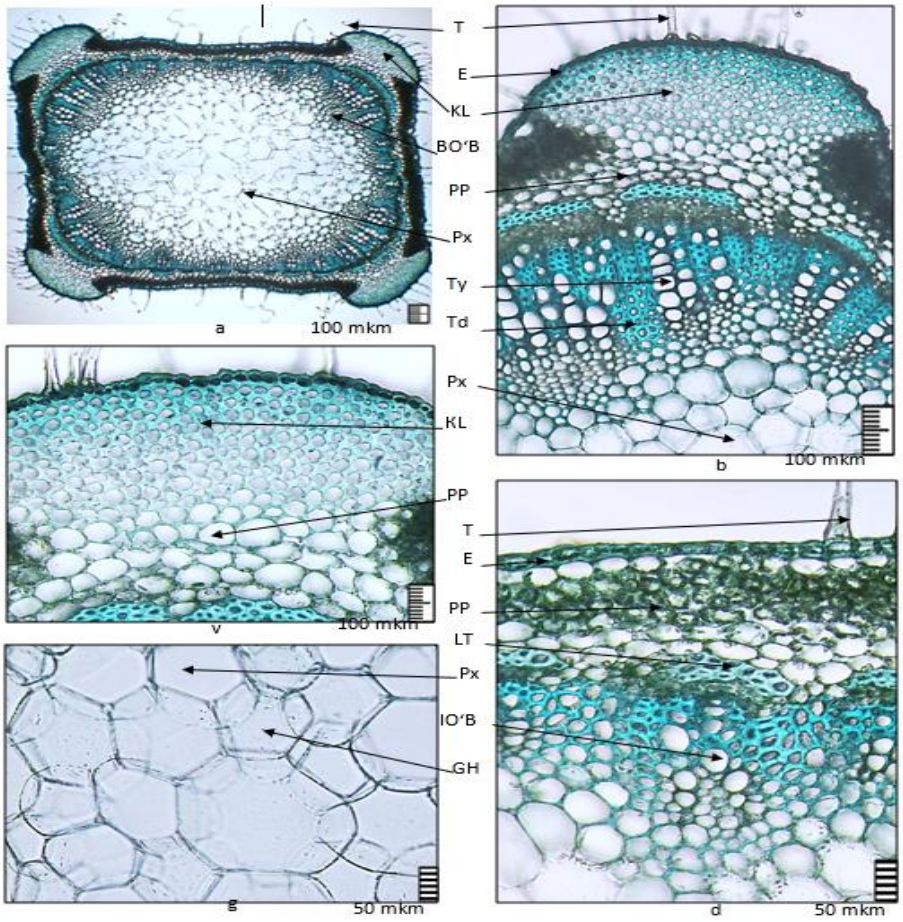


Figure 1. Anatomical structure of the transverse section of the inflorescence axis of *Salvia officinalis*:

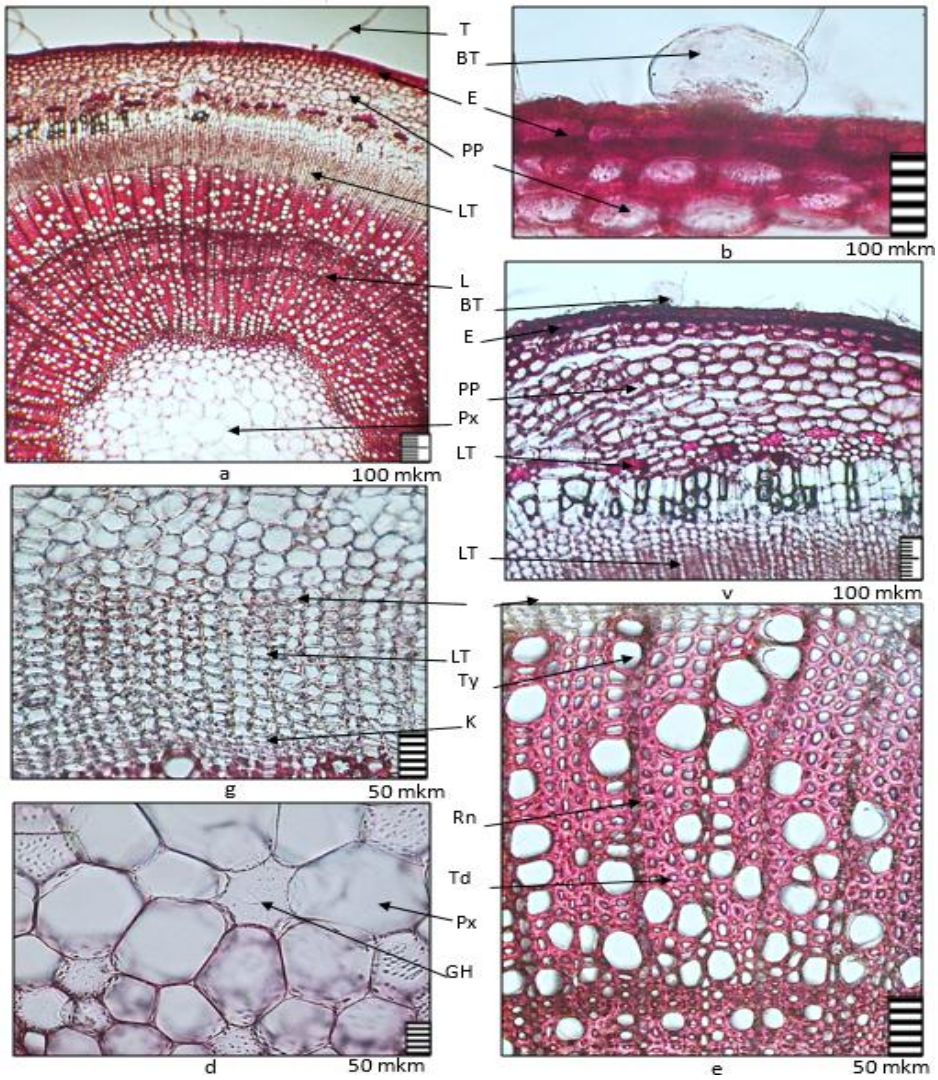
a – general view of the inflorescence axis; b – detailed view; v – epidermis, collenchyma, and cortical parenchyma cells; g – parenchyma and hydrocyst cells; d – vascular bundles. Legend: BO'B – primary vascular bundle; GD – hydrocyst cells; Io`B – secondary vascular bundle; KL – collenchyma; Ks – xylem; LT – bast fibers; PP – cortical parenchyma; Px – parenchyma cells; T– trichome; Td – tracheid; Ty – vessel (trachea); E – epidermis.

The basal part of the stem is rounded in cross-section and belongs to the non-bundled type. Secondary thickening is well developed due to the formation of secondary vascular tissues. The stem is covered externally by a single-layer epidermis with oval cells. Simple and multicellular glandular trichomes, including capitate and spherical forms, were observed, through which biologically active substances and essential oils are secreted.

Beneath the epidermis are 10–12 layers of cortex parenchyma cells. Bast fibers are arranged in a ring within the cortex. The cambial zone consists of several rows of tangentially elongated

cells. The wood parenchyma belongs to the diffuse-porous type.

Primary vascular bundles are located near the center of the stem, while secondary vascular tissues form a ring-shaped flattened cylinder. Secondary xylem vessels are numerous and vary in size. Tracheids, sclerenchyma, and sclerenchymatized parenchyma cells are also present. Radial ray cells are elongated, homogeneous, and rich in tannins. The pith contains large rounded-oval parenchyma cells and hydrocytic cells. (Fugure 2.)



Fugure 2. Anatomical structure of the stem of *Salvia officinalis*:

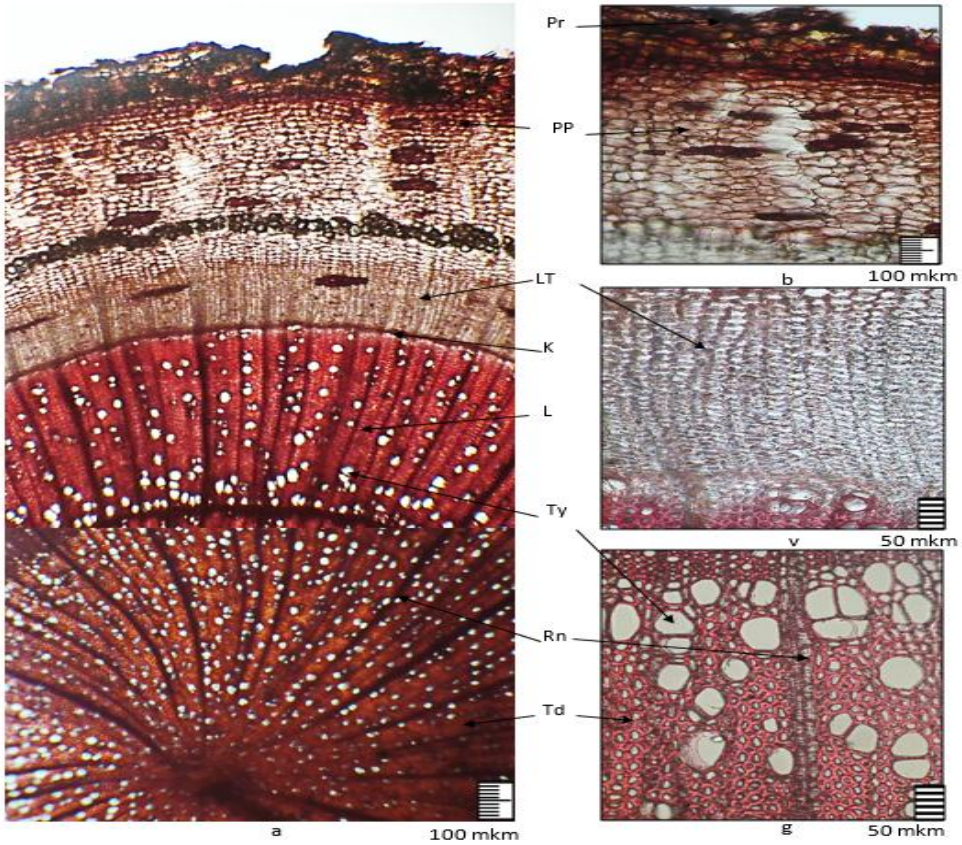
a – detail of the general view of the stem; b – epidermis and glandular trichome; v-g – cortical parenchyma and bast fiber; d – parenchyma and hydrocyst cell; e – secondary vascular bundle. **Legend:** BT – glandular trichome; GH – hydrocyst cell; K – cambium; L – libriform; LT – bast fiber; PP – cortical parenchyma; Px – parenchyma; Rn – radial medullary ray; T – trichome; Td – tracheid; Ty – vessel (trachea); E – epidermis.

The root is rounded in cross-section and belongs to the non-bundled type. Secondary thickening is strongly developed due to well-formed secondary vascular tissues and covering tissues.

The root is covered externally by a periderm consisting of phellem (cork), phellogen, and phelloderm. Beneath the

periderm are 13–14 layers of rounded-oval cortex parenchyma cells.

Brown biologically active substances were detected in the root cortex parenchyma and bast fibers. The wood tissue is of the diffuse-porous libriform type. Primary vascular tissues are located in the center of the central cylinder. Secondary vascular tissues form libriform tissue, among which sclerenchyma and sclerenchymatized parenchyma cells are present. Secondary xylem vessels of different sizes are arranged in a ring.



Anatomical structure of the root of *Salvia officinalis*:

a – detail of the general view of the root; b – periderm and cortical parenchyma; v – bast fiber and parenchyma; g – secondary vascular bundle and libriform. Legend: K – cambium; L – libriform; LT – bast fiber; PP – cortical parenchyma; Pr – periderm; Rn – radial medullary ray; Td – tracheid; TY – vessel (trachea).

Conclusion. The study identified important diagnostic features characteristic of the anatomical structure of the inflorescence axis, stem, and root of *Salvia officinalis L.* The quadrangular shape of the inflorescence axis, glandular trichomes in the epidermis, and well-developed collenchyma layers were observed. In the stem, secondary thickening, ring-shaped conducting tissues, clearly differentiated xylem and phloem elements, and hydrocytic cells were identified. The root was characterized by strong lignification, a well-developed periderm and central cylinder, and orderly vascular tissues. The accumulation of biologically active substances in the root cortex was also confirmed.

These anatomical characteristics serve as reliable diagnostic criteria for

the identification, standardization, and pharmacognostic analysis of *Salvia officinalis L.* raw materials and provide a scientific basis for the development of phytopreparations and various dosage forms.

References:

1. Toshmatov X.T., Abdullaev B.A. Pharmacognosy of Medicinal Plants. Tashkent: Fan, 2019.
2. Hodjieva D.T. Plant Anatomy and Morphology. Tashkent: Universitet, 2018.
3. Trease and Evans Pharmacognosy. London: Elsevier, 2009.
4. Esau's Plant Anatomy. Wiley, 2006.
5. Metcalfe C.R., Chalk L. Anatomy of the Dicotyledons. Oxford: Clarendon Press, 1950.
6. World Health Organization. Quality Control Methods for Medicinal Plant Materials. Geneva, 2011.
7. Karimov O.K., Yuldashev Sh.A. Prospects for the Use of Medicinal Plants in Uzbekistan. Pharmaceutical Journal, 2020.
8. Abdullaev N.A. Technology of Phytopreparations. Tashkent, 2021.