MORPHOLOGICAL AND ANATOMICAL STUDY OF UNDERGROUND ORGANS OF *SYRINGA VULGARIS* L.

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Introduction. Common lilac (*Syringa vulgaris* L.) is one of the most widespread and favorite ornamental plants in the world, often used in landscape design. It belongs to the *Oleaceae* family, which includes 31 species and more than 1600 varieties [7]. Representatives of the lilac genus are common in Southeastern Europe, Japan, China, the Himalayas, and Ukraine [5, 7, 11, 14]. Common lilac has a long history of use in traditional medicine in different countries. The bark, leaves, fruits, and flowers of the plant are known to have medicinal properties. In traditional Chinese medicine they are used as an analgesic, anti-inflammatory and stomachic agent, the fruits and bark of the plant are used as a tonic, and tincture of the leaves – for the treatment of malaria [5, 11, 14]. Japanese traditional medicine uses the flowers and bark of the plant as a diuretic and tonic.

Scientific evidence confirms the antioxidant, anti-inflammatory, antipyretic, immunomodulatory, antitumor and anti-allergic properties of common lilac raw materials [1-8, 10, 12, 13].

The bark of the plant is a natural source of syringine, which is a marker compound in the standardization of Eleutherococcus prickly pear drugs. However, the literature analysis shows that there is no information on a detailed study of the underground organs of common lilac. In order to expand the raw material base, we consider it expedient to study the underground organs of common lilac.

The aim of the study was research the morphological and anatomical structure of the underground organs of common lilac growing in Ukraine.

Materials and methods

The object of the study was roots and rhizomes of common lilac, which were harvested in the botanical garden of the NUPh. The experiment was conducted on 5 series of raw materials collected in the fall of 2023. Microdissections were prepared from dried soaked and freshly collected raw materials fixed in an ethanol-glycerin-water mixture (1:1:1) according to generally accepted methods [9]. The preparations were examined under a LOMO Mikmed 1 light microscope at 60-400x magnification; the results were recorded using a SCIENCELAB 10.0 MPix Color CMOS digital camera.

Results and discussion

The system of underground organs of common lilac depends on the age of the bush, the method of propagation (rhizomes are formed during vegetative propagation) and is somewhat divers in different varieties. Thus, in the first year, the system of the main root and hypocotyl (root neck) with adventitious roots develops. Subsequently, a mixed root system of the main and adventitious roots is formed, which later become dominant. Already from the second year, the bases of the main and lateral shoots of the bush are drawn into the soil by 2.5-5.0 cm. During the second growing season, horizontal stolon-like rhizomes rapidly grow from all the buds located in the cotyledon axils, lower stem leaves and adventitious hypocotyl buds. They are yellow-white, with brown scaly leaves, adventitious roots and dormant buds. After flowering begins, the development of rhizomes increases significantly.

With age, the main root system dies off and the bush has only rhizomes and superficial adventitious roots of shoots. It is characteristic that old rhizomes differ little from roots in morphology. Their surface darkens and becomes woody, leaf scales disappear, buds are not visible, and a dense system of root taproots is formed along the entire length, which go deeper by about 40 cm.

The roots are cylindrical, straight or slightly curved, curved, 10-15 mm thick. The surface is light brown, brownish. The cortex is scaly, sometimes flaky and exfoliating. At the break, the roots are light flesh-colored (ivory), fibrous-granular, with noticeable annual rings.

The periderm crust is multilayered, the phelloderm is narrow, 2-3-layered. The largest area is occupied by wood with radiating arrangement of vessels and tracheids. The medullary rays are 1-3-row, cells with starch grains (Fig. 1). In the bast, dense areas of bast fibers and sclereids alternate with arrays of conductive and basic tissues. Between the rings of thick- and thin-walled elements of the bast there are layers of large-cell parenchyma with large simple starch grains. The cambium is multi-rowed and clearly visible.

Studies of cross-sections of thin and thickened rhizomes (Fig. 6) showed that the periderm (Fig. 2) gradually grows due to the activity of the phylogeny. Thus, at first the cortex is 3-4-layered, with slightly thickened lignified membranes, the phylloderm is 1-2-layered. The cortex of perennial, lignified rhizomes is multilayered, dense, cortical parenchyma is obliterated. The secondary bark (Figs. 2, 3) is broad, consisting of several alternating belts of soft thin-walled and hard thick-walled bast. The hard cortex is represented by dense strands of narrow bast fibers with thickened lignified sheaths and large round or oval sclerites grouped in 2-4 or more. Their sheaths are significantly thickened, lignified, and permeated with slit-like pores. Core rays are primary, single, double or multiple rows, sinuous, cells narrow, with brownish contents. Cavities appear in the bark of perennial stems as a result of parenchyma obliteration. The wood (Figs. 2, 3, 4) is radiant, represented by medium-diameter porous vessels, ladder tracheids and libriform. The perimedullary zone of perennial rhizomes consists of cells containing a brownish secretion. The core parenchyma is loose, the cells are rounded, with more or less thickened porous membranes. The secondary cortex (Figs. 2, 3) is broad, consisting of several alternating belts of soft thin-walled and hard thick-walled bast.

DOI: 10.5281/zenodo.14274722

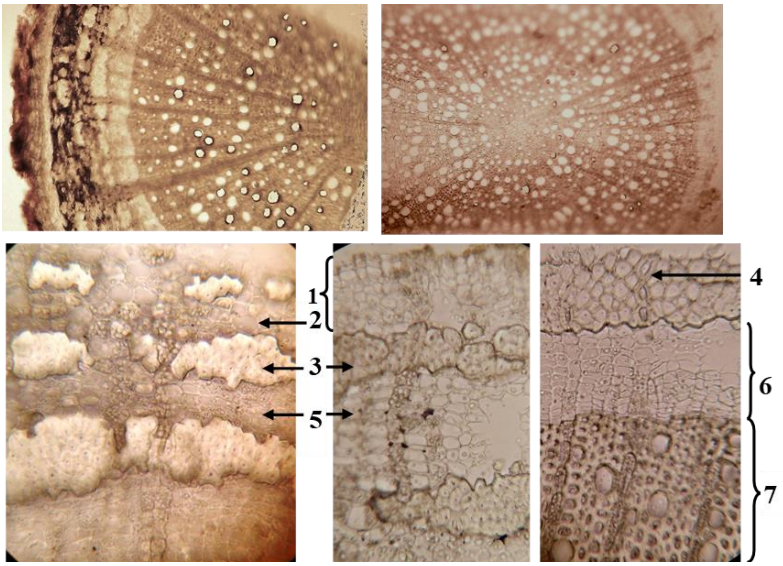

Fig. 1. Fragments of root cross-sections: 1 - periderm, 2 - storage parenchyma, 3 - bast fibers, 4 - sclereids, 5 - conductive elements of bast, 6 - cambium, 7 – wood.

The hard bast (Fig.7, 9) is represented by dense strands of narrow bast fibers with thickened lignified shells and large round or oval sclereids grouped in 2-4 or more. Their shells are significantly thickened, lignified, and permeated with slit-like pores.

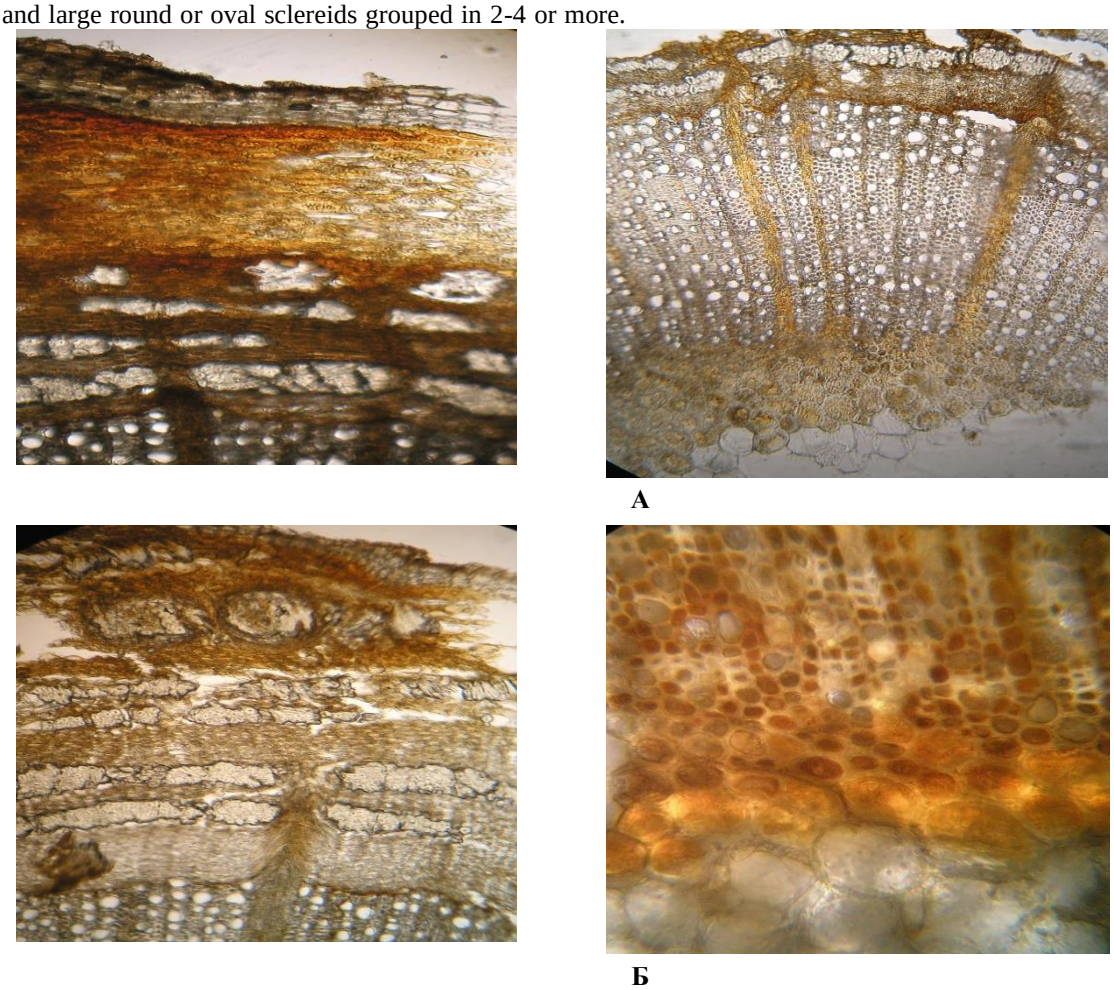

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Fig. 2. Fragments of cross-sections of annual (A) and perennial (B) rhizomes of common lilac

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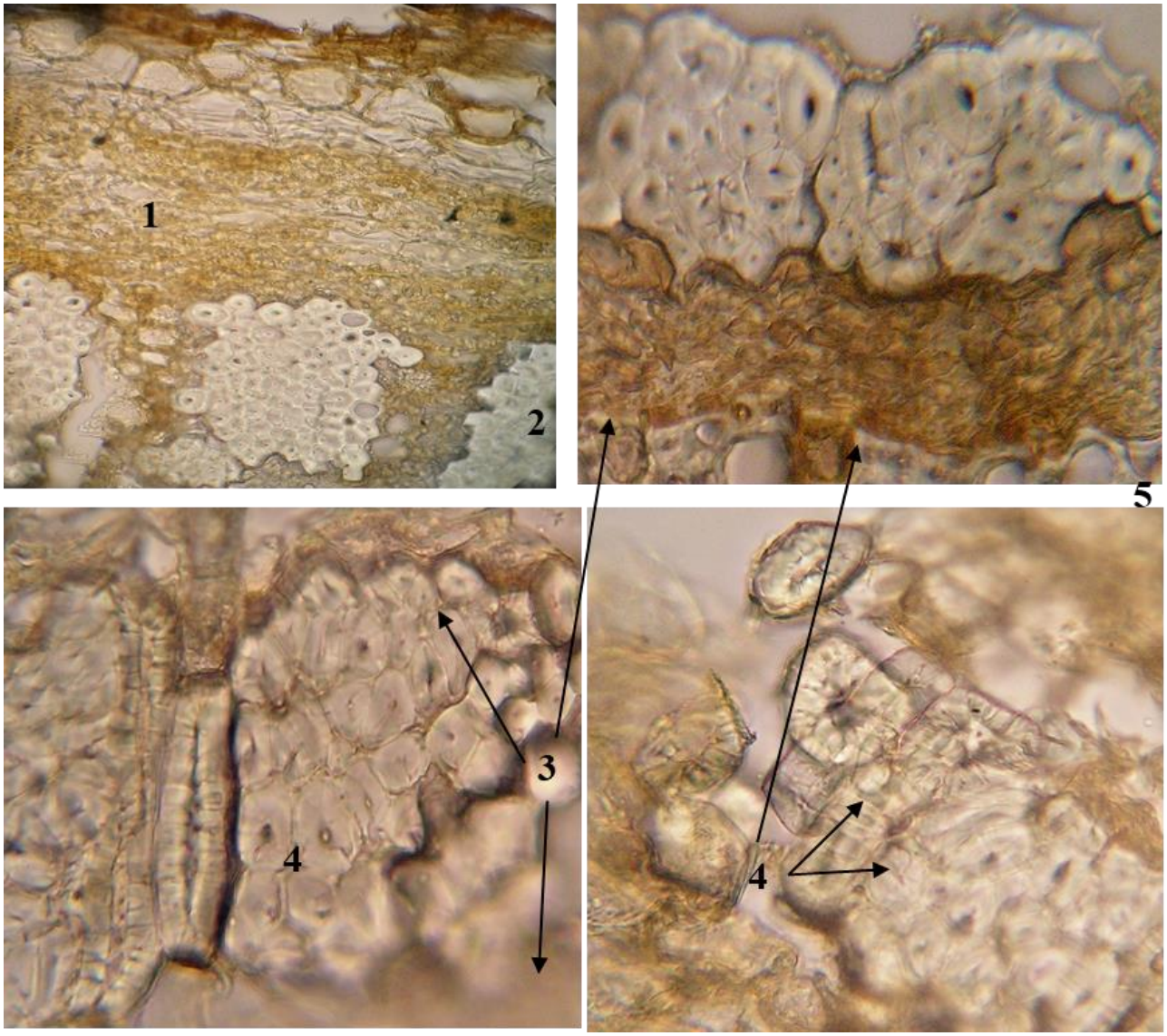

Fig. 3. Histological elements of the secondary cortex of rhizomes: 1 - periderm, 2 - collenchymatous and storage parenchyma, 3 - bast fibers, 4 - sclereids, 5 - soft bast (conductive elements and bast parenchyma).

Core rays are primary, single, double or multi-row, sinuous, narrow cells with brownish contents. Cavities appear in the cortex of perennial rhizomes due to parenchyma obliteration.

Wood (Figs. 4, 5, 10) is radiant, vessels of medium diameter, tracheids are ladder-shaped, wood fibers are significantly thickened. The parenchyma (Figs. 11) of the heartwood rays is brownish in color, forming single or multi-row strands. The perimedullary zone (Figs. 8) of rhizomes of all ages, and mostly perennial roots, consists of cells containing a brownish secretion. The core parenchyma is loose, the cells are rounded, with more or less thickened porous membranes.

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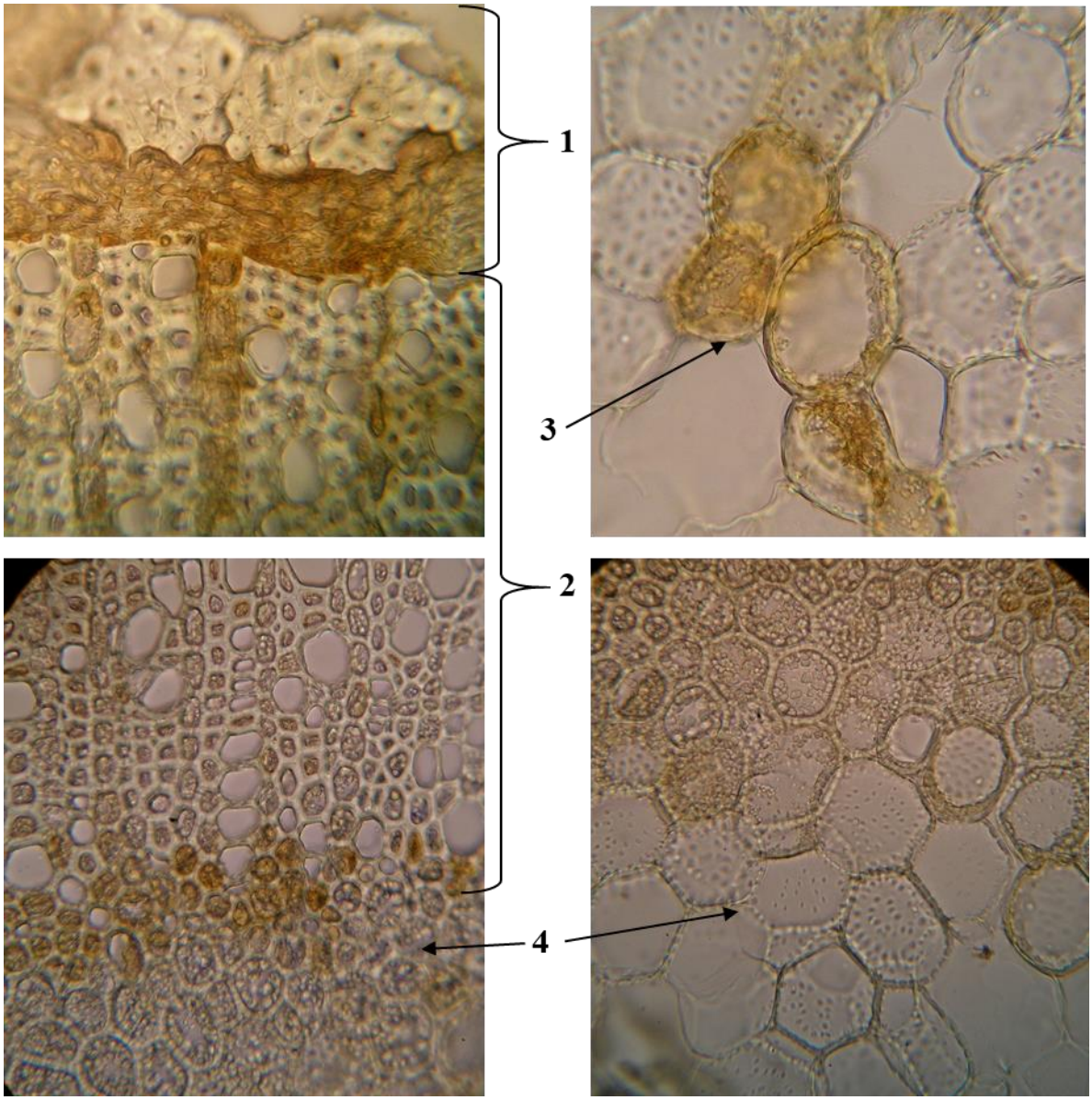
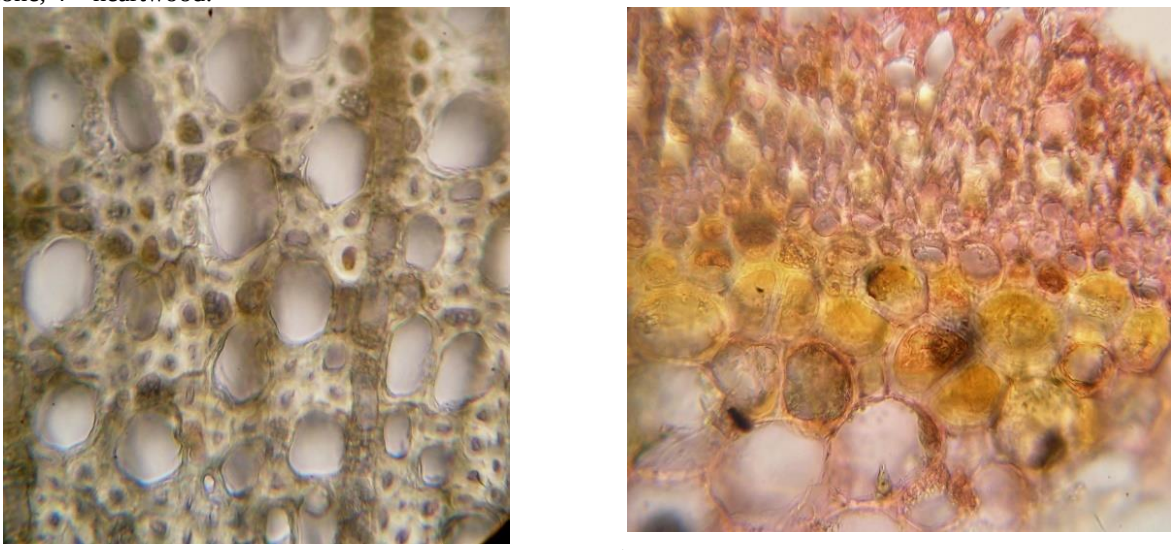


Fig. 4. Fragments of cross-sections of the rhizome axial cylinder: 1 - bast, 2 - wood, 3 - secretory cells of the perimedullary zone, 4 – heartwood.



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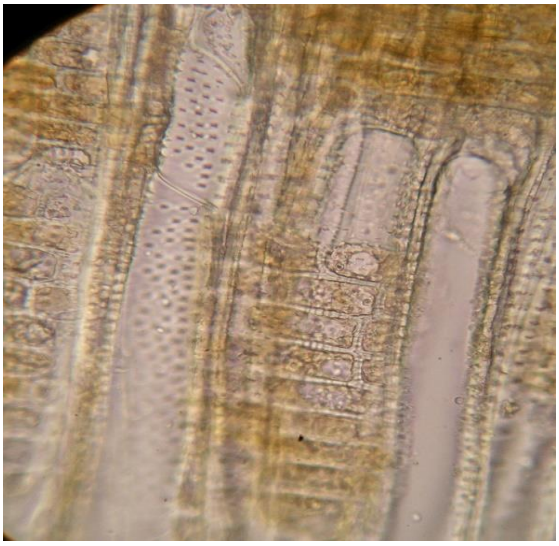

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Fig. 5. Transverse (A) and longitudinal (B) cross-sections of wood

Fig. 6. Cross section of annual rhizomes

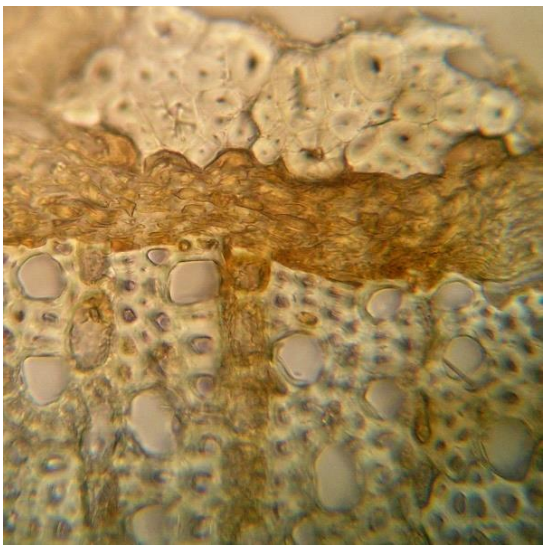

Fig. 7. Lub

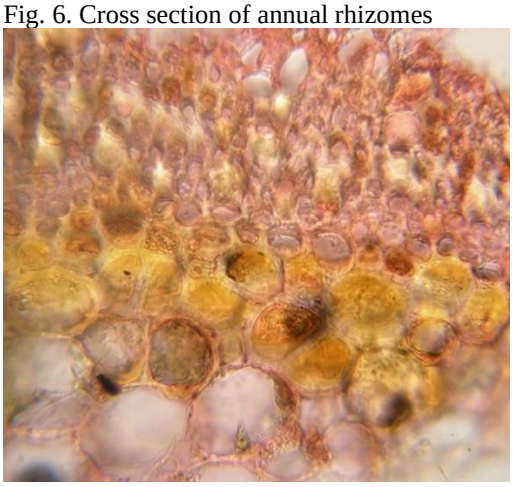

Fig. 8. Pigmented secretory cells of the perimedullary

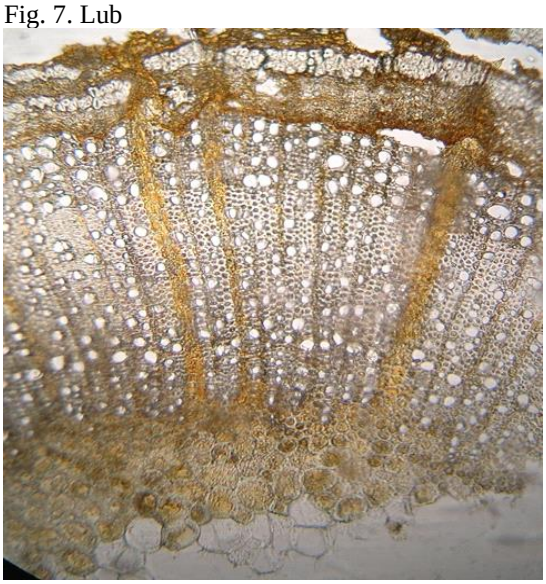

Fig. 9. Bast of perennial rhizomes

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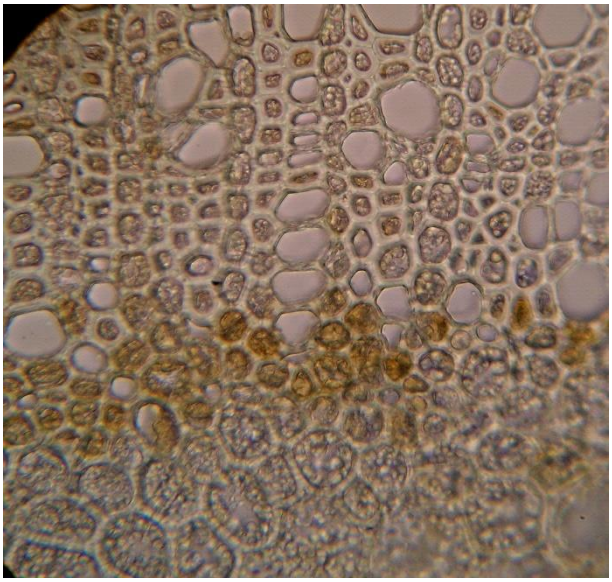

Fig. 10. Wood and core

Fig. 11. Pith parenchyma

Conclusions

1. The morphological characteristics of the roots and rhizomes of lilac were studied.
2. The anatomical structure of the underground organs of lilac was studied and the main diagnostic features of the studied raw materials were established.
3. The obtained results can be used for the development of quality control methods for roots and rhizomes of lilac.

Conflict of interest: none**.**

Morphological and anatomical study of underground organs of *Syringa vulgaris* l.

Andriy Popyk, Victoriia Kyslychenko, Olena Iosypenko, Olena Novosel, Kateryna Skrebtsova

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Keywords: *Syringa vulgaris* L , roots and rhizomes.

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DOI: 10.5281/zenodo.14274722