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Morphological and Anatomical Features of the Structure of Vegetative and Generative Organs of *Lycium Chinense* Mill. and *Lycium Barbarum* L. Solanaceae Juss. in the Conditions of Uzbekistan

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ABSTRACT

The characteristics of *Lycium chinense* Mill and *Lycium barbarum* L., species, taxonomy, origin and use in medicineare given. The adaptation of these plants in the conditions of the Botanical Garden of Tashkent, as well as in the conditions of the Namangan region, was studied. The morphological and anatomical structures of two species of the genus *Lycium* have been studied. The morphology and structure of vegetative and generative organs, which differ from each other in leaf shape and venation, are described. Leaf cells are studied in detail: the epidermis of the upper side has a smaller number of stomata, which makes it possible to reduce the evaporation of water in summer drought conditions. The spongy parenchyma is chlorophyllon-bearing. Calcium oxalate was found in palisade and spongy parenchyma cells. Conductive bundles of bicollateral type are numerous, consist of phloem and xylem. The center of the petiole has one vascular bundle with a closed bicollateral type. Parenchymal cells are thin-walled, but some have hydrocytic cells. The petiole of the leaf in a transverse section is of the parenchymal-fascicular type, has numerous parenchymas and vascular bundles. Collenchyma is located under the epidermis, based on osmotic phenomena. The stems are sclerified, helping to resist various environmental influences. It was found that with age, the cambium changes the anatomical structure of the stem, and also annually produces secondary xylem.The fruit of *Lyciumchinense* is a berry, syncarpous and 2-celled. Nucleoli were found in the epidermis. On a transverse section, the pericarp consists of several parenchymal cells, the walls of the epidermis are thickened and cutinized. The mesocarp consists of multi-row parenchymal cells. They are tangentially elongated in the outer layers, and rounded in the inner ones. Endocarp of irregular shape. The seeds of *Lyciumchinense* are large, round, and have a beak-shaped rib. The cells of the outer epidermis become lignified over time. The parenchyma of the intigument is enclosed between the epidermis. The perisperm is absent. The endosperm is of a cellular type, the endosperm cells contain oil droplets and aleurone grains.

Based on the results, morphological-anatomical-histological features were determined. The data obtained can serve to identify plant materials, in environmental studies, as well as to determine diagnostic features.

KEYWORDS: Genus *Lycium*, *Lyciumchinense* Mill., *Lyciumbarbarum* L. application, morphology, anatomy, leaves, petiole, stem, wood, fruit, seeds.

INTRODUCTION

Recently, the biological resources of many medicinal and useful plants growing in Uzbekistan have been sharply reduced. Restoration and reproduction of natural resources lasts a long period of time. Therefore, restoration, reproduction and adaptation to climatic conditions are necessary. Medicinal and useful plants include currants, plums, blackberries, rose hips, gooseberries, raspberries, and among them Goji, which surpasses them several times.

The homeland of the plant is China: the provinces of Gansu, Hebei, Mongolia, Shanxi, Xinjiang, Sichuan. Introduction to culture on large plantations was carried out in the north of the central part of China in the Ningxia region, in Tibet and the Himalayas. In addition, wolfberry is cultivated throughout Eurasia, including in Russia, Ukraine and Belarus.

Goji can be seen in a feral state, found in the Kuban, in the Primorskiy Territory, in the Caucasus and in Central Asia. Goji can be grown as an ornamental plant with the condition of annual shearing of old branches.Goji belongs to the *Solanaceae* family and the *Lycium* genus. The fruits (berries) of this plant have a rich chemical composition and are widely used in traditional medicine in China, Argentina, Greece, Italy, the United States and East Asian countries and are used as medicinal raw materials and food additives [6,8,13]. *Lycium chinense* Mill preparations and *Lycium barbarum* L. (Lycium halimifolium Mill.)preparations are widely used.

In many countries, including Vietnam, China, wolfberries are registered in pharmacopoeias and are actively used as a tonic, hypoglycemic, immunomodulatory, antioxidant, antimicrobial, anti-inflammatory and tonic agent, as well as to improve digestion, nourish the kidneys and improve fertility, etc. [20,21,22,23,24,25,26,27]. In the conditions of our country, the pharmacopoeial properties of these plants are being studied.

Goji species growing in the conditions of the Aral Sea region are considered salt-tolerant. There are some sources that also indicate the salt tolerance or tolerance of these shrubs [15, 19].

Interest in wolfberry fruits has also grown significantly in European countries, due to the appearance on the market of biologically active additives (BAA) to combat overweight (obesity), strengthen immunity and maintain a healthy state of the body as an anti-aging phytotherapeutic agent [8,9,16]. The plant material of wolfberry has a rich chemical composition, it contains: betaine, rutin, ascorbic acid, daucosterol (beta-sitosteryl-beta-D-glucoside), polysaccharides, unsaturated fatty acids (omega-3.6), vitamins B1, B2, nicotinic acid, carotenoids, as well as trace elements (calcium, phosphorus, iron, sodium, magnesium, manganese, potassium, etc.) and 18 amino acids [17, 30]. The polysaccharide *Lyciumbarbarum* L., the main component of the Chinese wolfberry, is characterized by high biological activity and significant content [26].

In this regard, the study of the morphological and anatomical structure of the vegetative and generative organs of *Lyciumchinense* Mill is of scientific interest. (chinese wolfberry, goji) and *Lyciumbarbarum* L. (common wolfberry, goji), growing under the conditions of introduction.

In the conditions of the Botanical Garden of Tashkent, as well as in the Namangan region, agrobiological features, methods of reproduction and technology for growing plants of *Lyciumchinense* Mill. and *Lyciumbarbarum* L. were studied [7, 8, 9, 10, 11, 12].

PURPOSE AND OBJECTIVES OF THE STUDY

The aim of the research is to study the morphological and anatomical features of the vegetative and generative organsstructure of *Lyciumchinense* Mill. and *Lyciumbarbarum* L. to determine the diagnostic features and localization of biologically active substances of this species.

OBJECTS AND METHODS

The objects of research are plant species *Lyciumchinense* Mill. and *Lyciumbarbarum* L. growing in Uzbekistan. We studied morphological features and carried out the description. Samples of vegetative and generative organs were fixed in 70% ethanol and anatomical examination was performed. Cross sections of the leaf, petiole, stem, fruit and seeds were prepared manually using a safety razor. Transverse sections of the leaf are made through the middle, and the petiole, stem - through the base, fruits and seeds - serially. Sections were stained with methylene blue and safranin followed by gluing in glycerol [1]. Descriptions of the main tissues and cells are given in C.R. Metcalfe, L. Chalk [2], K. Esau [3], E.A. Sokolov [4], epidermis according to S.F. Zakharevich [5]. Microphotographs were taken with a digital camera with a computer microphotographic attachment brand A123 from *Canon* under a microscope *Motic B1-220A-3*.

RESULTS AND DISCUSSIONS

***Lyciumchinense*Mill.**Perennial deciduous shrub, without thorns.Leaves of *Lyciumchinense*Mill.are formed on the shoot individually in an alternating order or in bunches from 2 to 4. The shape of the leaf blade is ovoid, rhombic, lanceolate or linear-lanceolate with an entire edge and a short petiole. On the paradermal section, the outlines of epidermal cells on the adaxial side are slightly sinuous, the projection is polygonal, while the abaxial one is more sinuous, the projection is polygonal. The cells of the adaxial (upper) epidermis are larger than those of the abaxial (lower). In the cell membranes of the epidermis, nucleoli are clearly visible on both sides of the leaf (Fig. 1).

The leaves are amphistomatic, the stomata are located on both sides of the leaf blade, located transversely to the longitudinal axis of the leaf. [14,18]. The shape of the stomata is round-oval. The upper (adaxial) epidermis has a significantly smaller number of stomata compared to the lower (abaxial) epidermis. All this leads to a reduction in water loss from the surface of the leaf. The guard cells of the stomata on both sides of the leaf are almost the same length. Stomata are not submerged, hemiparacytic and anomocytic types (Fig. 1, 2).

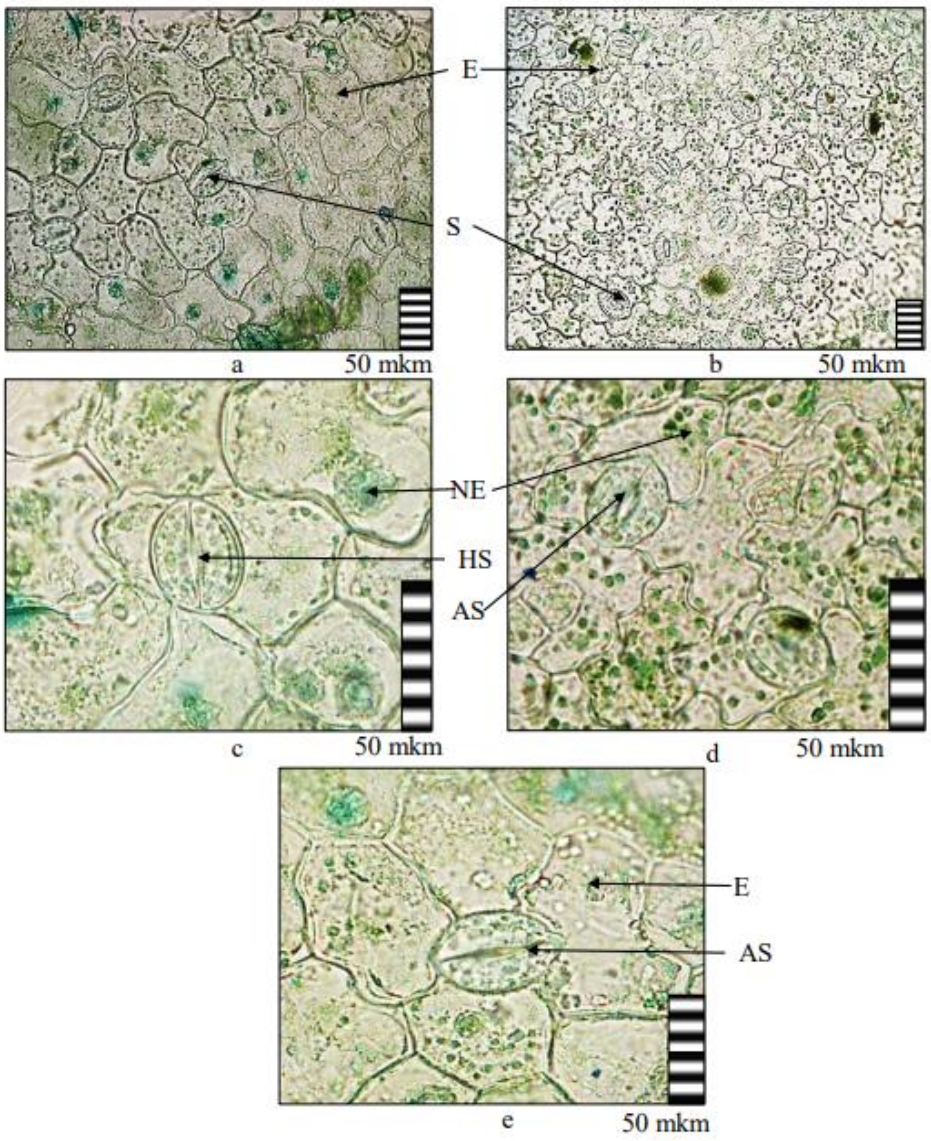

Fig. 1: Anatomical structure of the leaf epidermis of *Lycium chinense* Mill:
a, c, e-upper (adaxial) epidermis; b, d-lower (abaxial) epidermis.
Symbols: AS-anomocytic type of stomata, HS-hemiparacytic type of stomata, S-stomata,
E-epidermis, NE - nucleolus of the epidermis. Magnification - 50-100 micron.

Leaf mesophyll on a cross section of the dorsiventral type, which is represented by palisade cells located under the upper epidermis of the leaf mesophyll, spongy cells - above the lower epidermis of the leaf mesophyll. The epidermis is represented by one row of cells with a thin-walled cuticle layer. The cells of the adaxial epidermis are larger than those of the abaxial epidermis. Between the adaxial and abaxial epidermis is an assimilation tissue consisting of palisade and spongy cells. Beneath the adaxial epidermis lies the palisade parenchyma. The palisade parenchyma is chlorophyll-bearing, large and elongated, which consists of one row of cells and is located between the adaxial epidermis and spongy leaf parenchyma (Fig. 2).

The spongy parenchyma is chlorophyll-bearing, consists of 3-4 rows and is located between the palisade parenchyma and the abaxial epidermis. The spongy parenchyma is round, large- and small-celled with large cavities. Between the palisade and spongy cells are numerous lateral vascular bundles, with 3-4 small vessels. Calcium oxalate occurs in the form of crystalline sand in palisade and spongy parenchymal cells (Fig. 2) [9].

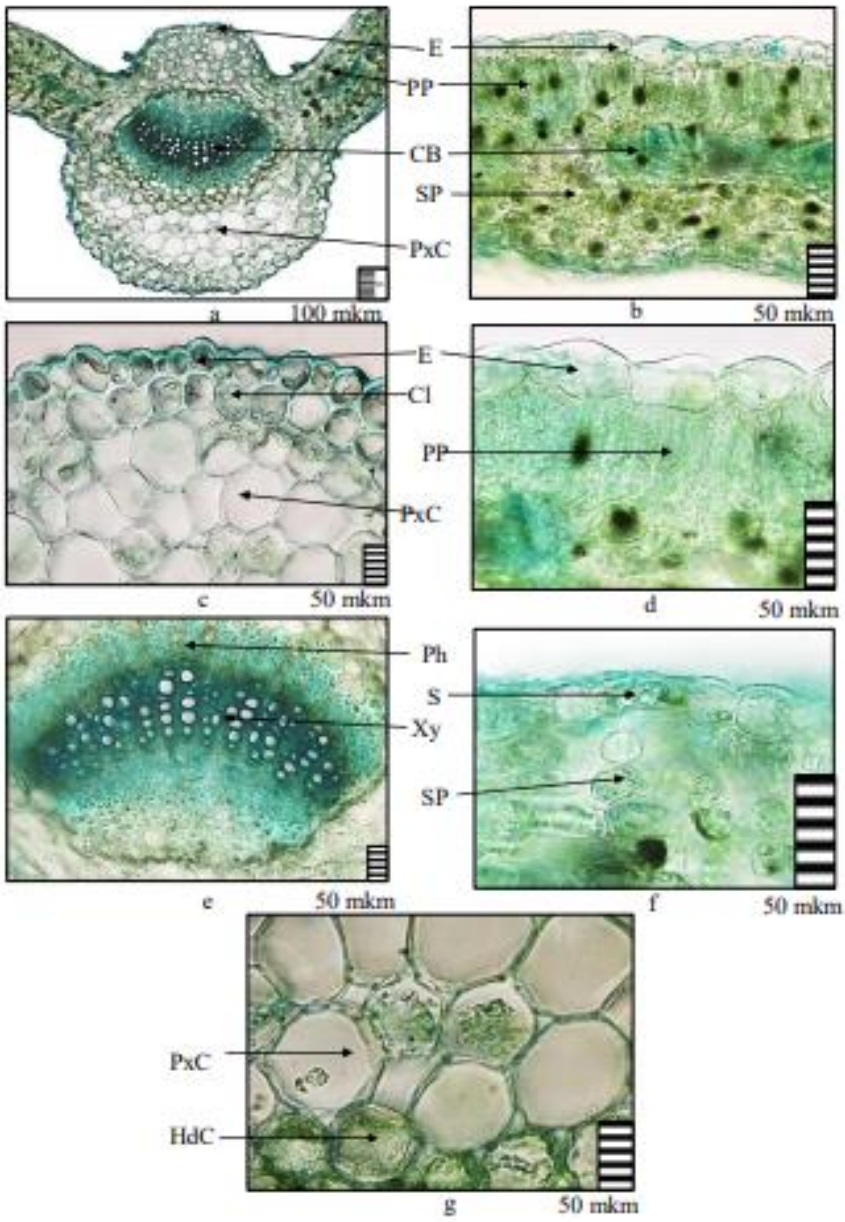

Fig. 2: The anatomical structure of the leaf of *Lycium chinese* Mill:
a-general view of the main vein of the leaf; b-mesophyll of the leaf; c-epidermis and collenchyma; d-palisade parenchyma; e-conducting bundle; f-spongy parenchyma and non-submerged stomata; g-parenchymal and hydrocytic cells.
Symbols: HC-hydrocytic cells, SP-spongy parenchyma, Cl-collenchyma, X-xylem,
PP-palisade parenchyma, CB-conducting bundle, PC-parenchymal cells, S-stomata, Ph-phloem, E-epidermis. Magnification - 50-100 micron.

The main leaf vein protrudes on the abaxial side. The rest of the vein is occupied by the main parenchyma, into which one vascular bundle is immersed; parenchyma cells are thin-walled, round-oval in shape, among which hydrocytic cells are found. Conductive bundles of closed bicollateral type, numerous, consisting of phloem and xylem. Xylems are thin-walled, elongated. Their walls are thickened in the form of spirals (Fig. 2).

The petiole of the leaf on a transverse section of the parenchymal-beam type, consists of a single-row epidermis, numerous parenchyma and vascular bundles. The petiole protrudes on the underside of the leaf. Under the epidermis there is a lamellar single-row collenchyma (Fig. 3).

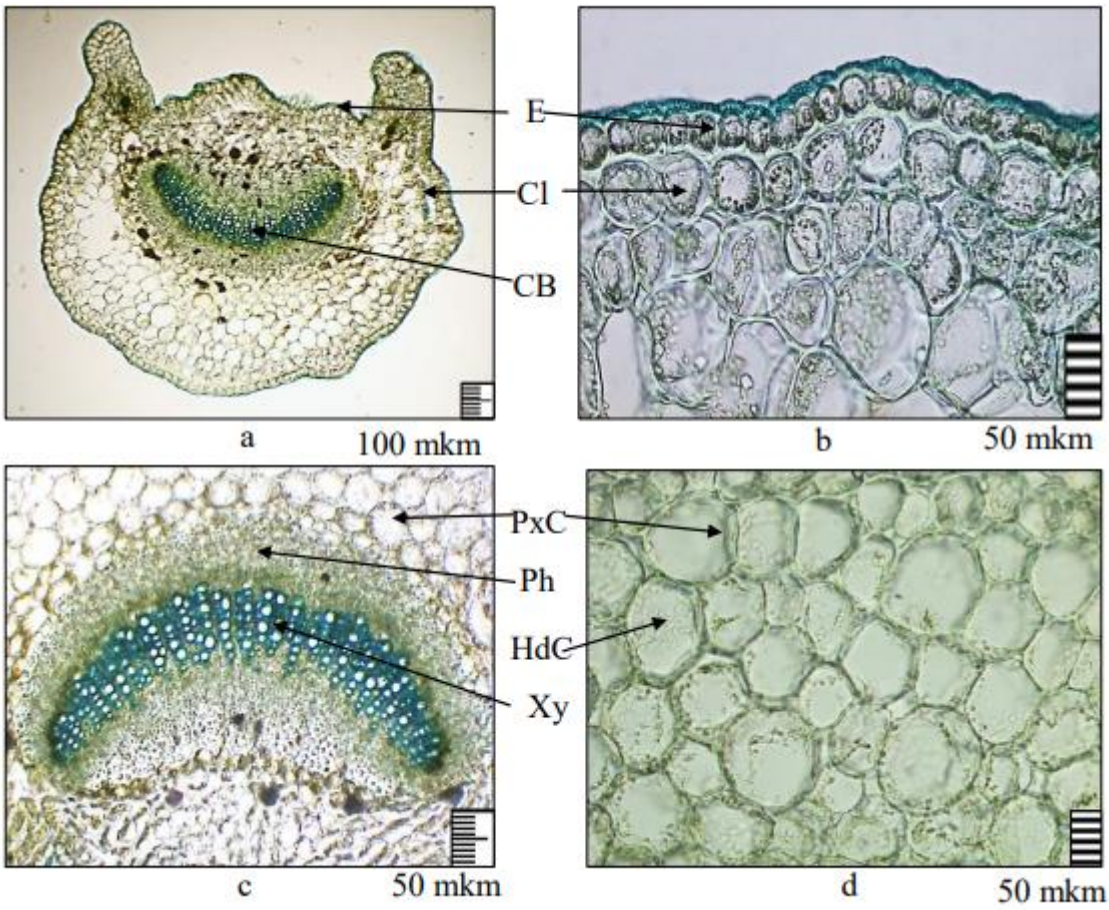

Fig.3. The anatomical structure of the leaf petiole of *Lycium chinense* Mill:
a – general view; b – epidermis and collenchyma; c – closed bicollateral vascular bundle; d – parenchymal and hydrocytic cells. Symbols: HC - hydrocytic cells, Cl - collenchyma, X - xylem, CB-conducting bundle, PC - parenchymal cells, Ph - phloem, E - epidermis. Magnification - 50-100 micron.

In the center of the petiole there is 1 vascular bundle. Conductive bundle, closed bicollateral, kidney-shaped form, which consists of phloem and xylem. The arrangement of the vessels of the conducting bundle is chain-shaped. Parenchymal cells in the central part of the petiole are thin-walled, round, oval, and there are hydrocytic cells (Fig. 3) [9].

The base of the stem on a transverse section is round-ribbed or square in shape, with a beam type of structure. The anatomical structure of the stem is divided into two topographic zones: the cortical parenchyma and the central cylinder (Fig. 4).

The costal part of the stem is the most sclerified, due to sclerenchyma cells. Sclerenchyma cells consist of 7-8 rows. The epidermis is single row. The primary cortex is often collenchyma in the outer part, due to collenchyma cells. The cortical parenchyma is round-oval, which consists of 4-5 rows and is preserved throughout. An extensive phloem is located under the cortical parenchyma (Fig. 4).

The wood occupies a solid cylinder surrounding the core, which is located in a central position in the stem. The primary conductive tissues are preserved in the stem, and then the secondary ones immediately form a solid cylinder, which in the cross section looks like an almost continuous ring. With age, the emerging cambium changes the anatomical structure of the stem. It produces secondary xylem (wood) annually. In the direction of the xylem, the cambium works more vigorously, pushing the primary xylem to the core. Secondary xylem, which occupies most of the section, is easy to identify, since its cells are stained red-brown. It is represented by tracheids located in radial rows and few rows, elongated and short medullary rays. Rays sometimes are exclusively one-sided or with only sparse biseriate rays (Fig. 4).

Vessels are located in separate inclined groups of vessels, which look like annular porous and spiral thickenings are observed. The intervascular pits on the radial and ligamentous parenchyma are usually simple and elongated, but similar in size and shape to the intervascular fossa. The wood parenchyma is usually sparse and limited to a few cells or a narrow sheath around each vessel; predominantly apotracheal, such as scattered cells or irregular unicavity streaks. The core is wide, represented by large and small round-oval, thin-walled parenchymal cells and they contain

hydrocytic cells. Calcium oxalate is absent in the cortical parenchyma and core, it is noted in the form of crystalline sand (Figure 4).

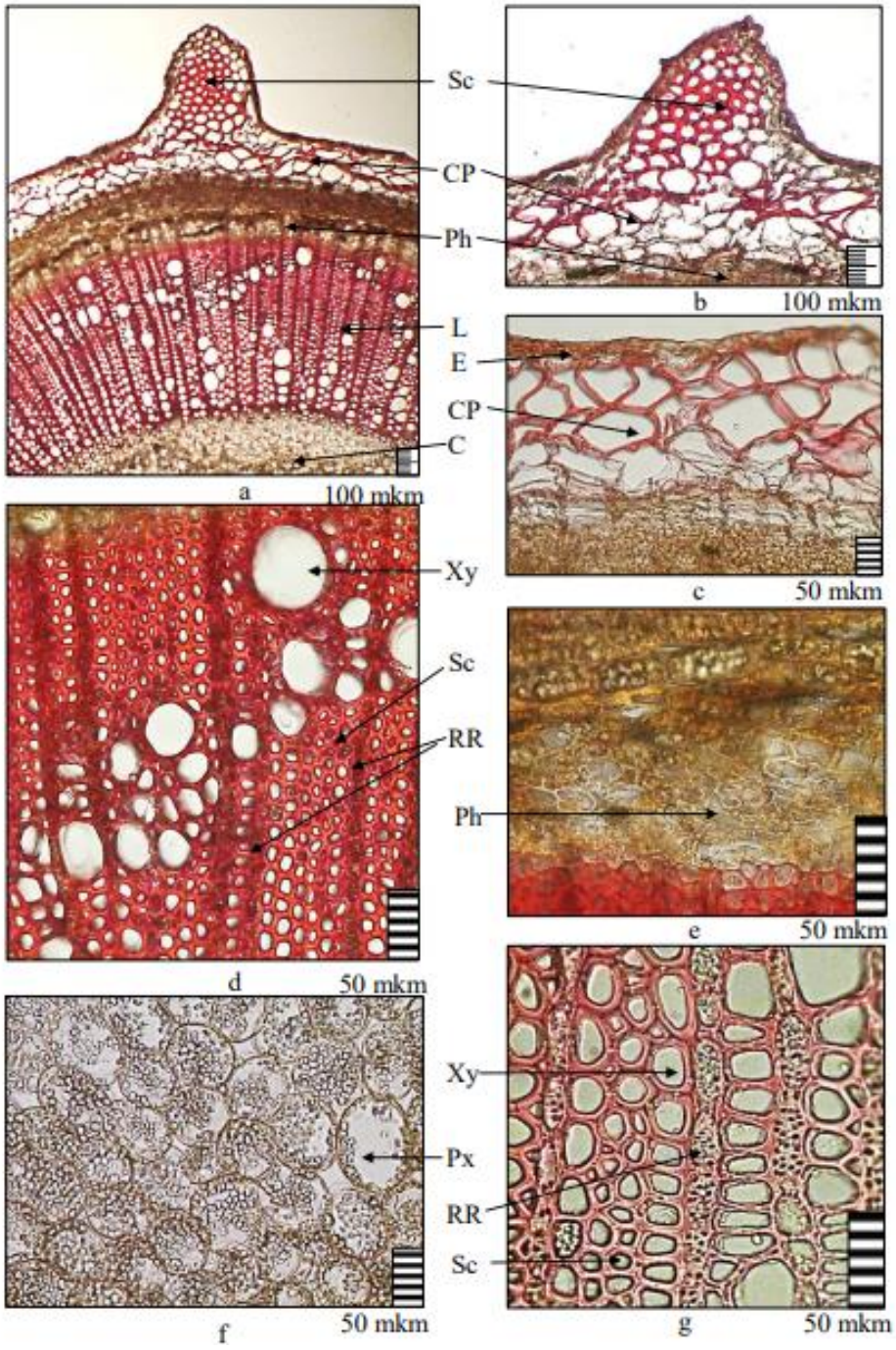

Fig. 4. Anatomical structure of the stem of Lycium chinense Mill. on a cross section:
a - general view of the stem; b - costal part of the stem; c, f – cortical parenchyma;
d, g- libriform and secondary conducting bundles; e - core.
Symbols: HC - hydrocytic cells, CP - core parenchyma, X - xylem, L - libriform,
P - parenchyma, RR - radial rays, C - core, Sc - sclerenchyma, Ph - phloem, E - epidermis. Magnification - 50-100 micron.

The fruit of *Lyciumchinense* Mill. - berry, ovoid-oblong, syncarpous with a bright red veil and 2-celled. On the paradermal section, the outlines of epidermal cells are rectilinear, the projection is rounded. In the cell membranes of the epidermis, nucleoli are clearly visible.

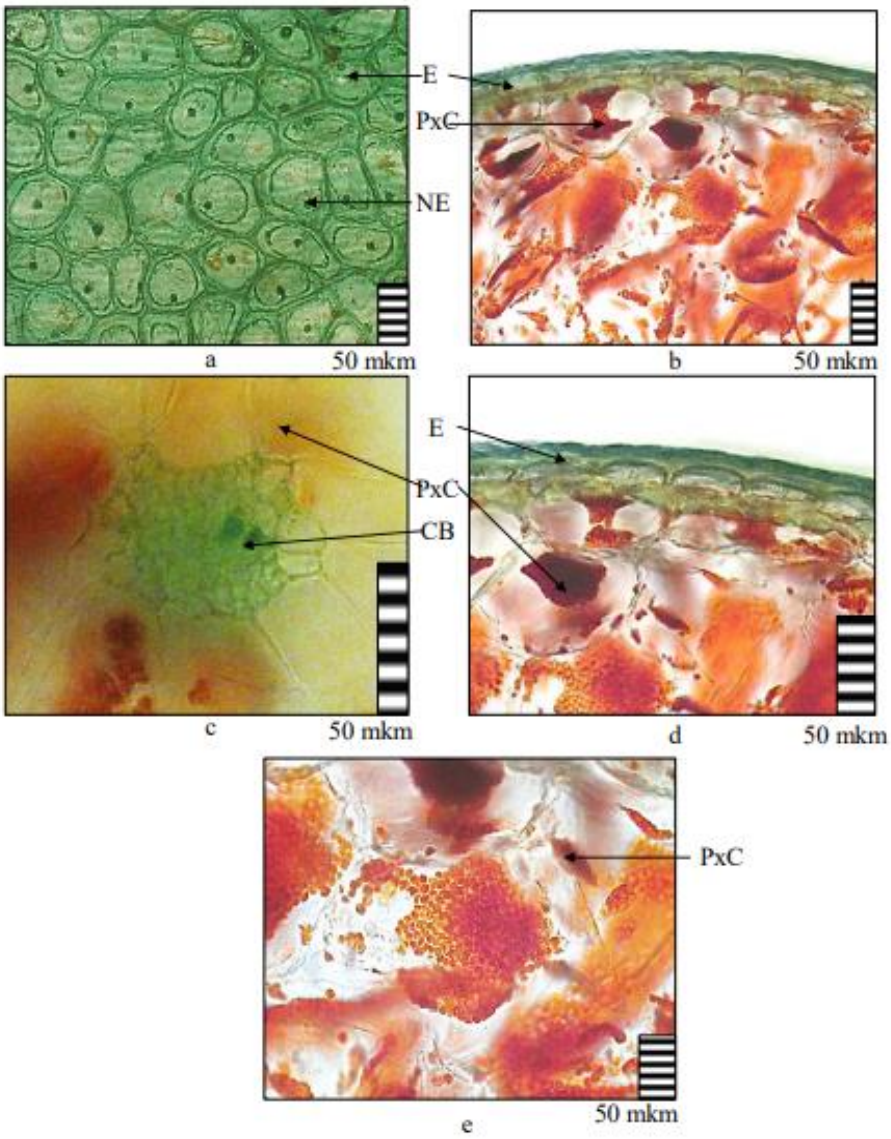

Fig. 5. Anatomical structure of the pericarp of the fruit of *Lycium chinense* Mill:
a – the epidermis of the fruit on the paradermal section; b, d, e – epidermal and parenchymal cells in a cross section; c – conducting beam.
Symbols: CB - conducting bundle, PC - parenchymal cells, E - epidermis,
NE - nucleolus of the epidermis. Magnification - 50-100 micron.

In cross section, the pericarp consists of several layers of large, rounded parenchymal cells. The walls of the outer epidermis are thickened and cutinized. The cells of the outer epidermis are elongated in the radial direction, gradually losing their contents, while their walls thicken and lignify. In the fruit of mesocarps there are multi-row large parenchymal cells, which are slightly elongated in the tangential direction in the outer layers, and rounded in the inner ones. There is a conducting bundle between the parenchymal cells. Parenchyma cells around the vascular bundles, especially in the inner part, are small and elongated in the radial direction. The endocarp consists of rather small, irregularly shaped cells (Fig. 5).

Seeds of *Lyciumchinense* Mill. are large, rounded, flat, reniform-elongated, at the seed hilum more or less elongated into a beak-shaped spout (Fig. 6).

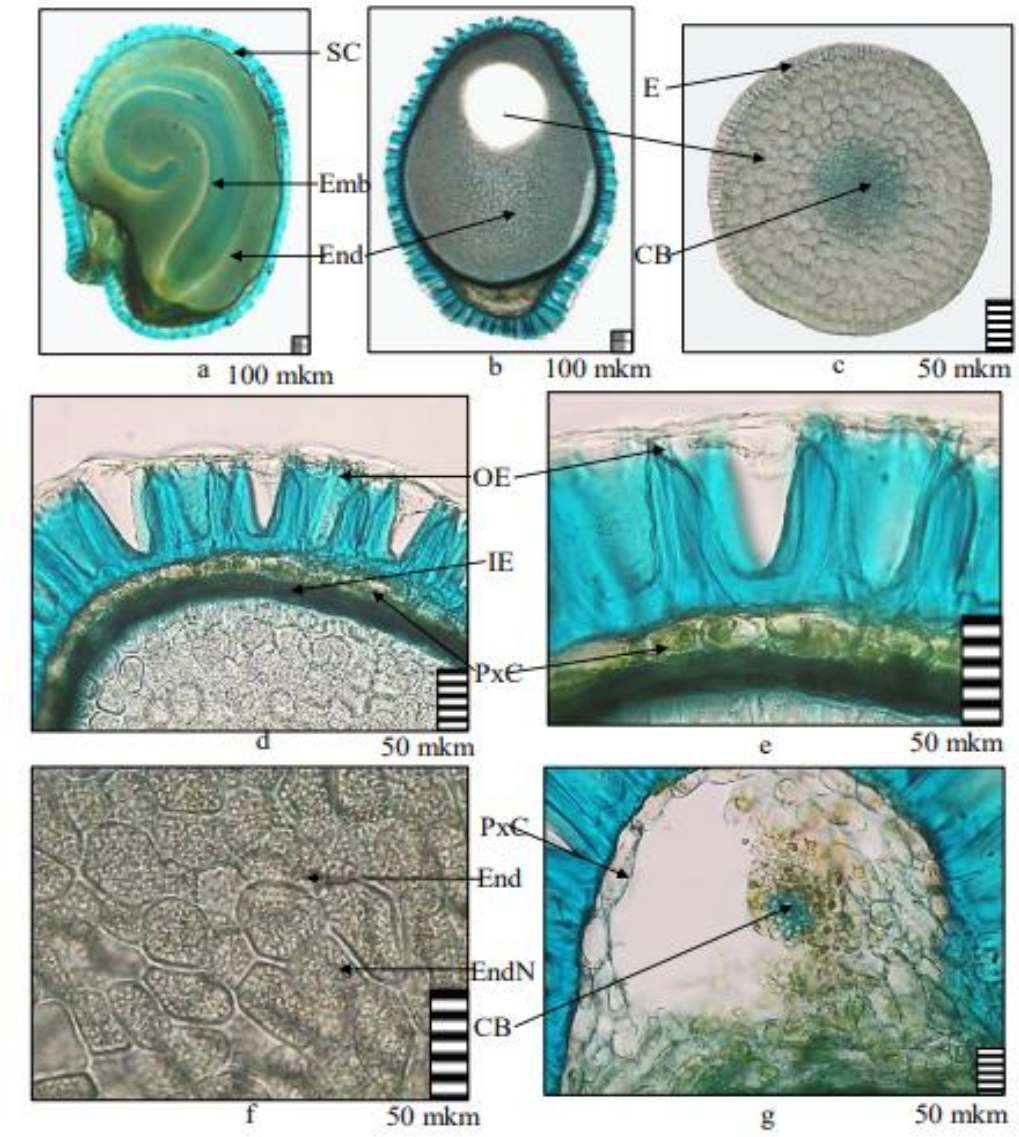

Fig. 6. Anatomical structure of the seeds of *Lycium chinense* Mill:
a - general view of seeds in a longitudinal section; b - general view of seeds in a cross section; c - spine; d-e - seed peel; f- endosperm; g- parenchyma and vascular bundles.
Symbols: IE - inner epidermis, Emb - embryo, OE - outer epidermis, CB - conducting bundle, PC - parenchymal cells, SC - seed coat, E - epidermis, End - endosperm, EndN - endosperm nucleolus. Magnification - 50-100 micron.

The surface of the seeds is warty-wavy, multifaceted. The coloration is light yellow. On a transverse section, the seed coat consists of the outer epidermis (exotesta), remnants of the integumental parenchyma, and the inner epidermis (endotesta). From the surface, the outer epidermal cells have a sinuous shape, their inner periclinal walls and the inner part of the anticlinal walls are thickened.

In *Lyciumchinense* Mill.the seed coat is formed by cells of the outer epidermis and obliterated layers of cells of the integumental parenchyma. The cells of the outer epidermis receive peculiar thickenings at the base and become lignified. Between the inner and outer epidermis are strongly compressed remnants of the cells of the parenchyma of the integument. The perisperm is absent. Endosperm is of cellular type. The endosperm consists of large, elongated, tightly closed cells with significantly thickened cell walls. Endosperm cells contain oil droplets and aleurone grains. Endosperm cells are with prominent nucleoli (Fig. 6).

The embryos are curved, chlorophyll-free, differentiated into two cotyledons, hypocotyl, shoot apex, and radicle. The embryonic cells contain oils and aleurone grains (Fig. 6).

LyciumBarbarum L. is a deciduous perennial densely branched shrub, the branches are covered with thin, non-leafy spines.

The leaves of *Lyciumbarbarum* L. (*Lyciumhalimifolium* Mill.) are narrowly elliptical, elliptical, oblong-lanceolate, on short petioles, the widest in the middle

part, they are pointed or blunt at the apex, the bases are wedge-narrowed. On the paradermal section, the outlines of epidermal cells on the adaxial side are slightly sinuous, the projection is polygonal, on the abaxial one they are strongly sinuous, the projection is polygonal. The cells of the adaxial (upper) epidermis are larger than those of the abaxial (lower). In the cell membranes of the epidermis, nucleoli are clearly visible on both sides of the leaf. Our studies have shown that the presence or absence of trichomes can serve as an informative sign. The leaf adaxial epidermis is covered with simple multicellular trichomes (Fig. 7).

The leaves are amphistomatic, the stomata are located on both sides of the leaf blade, located transversely to the longitudinal axis of the leaf. The shape of the stomata is round-oval. The upper (adaxial) epidermis has a significantly smaller number of stomata compared to the lower (abaxial) epidermis. All this leads to a reduction in water loss from the surface of the leaf. The guard cells of the stomata on both sides of the leaf are almost of the same length. The stomata are not submerged, anomocytic type (Fig. 7, 8).

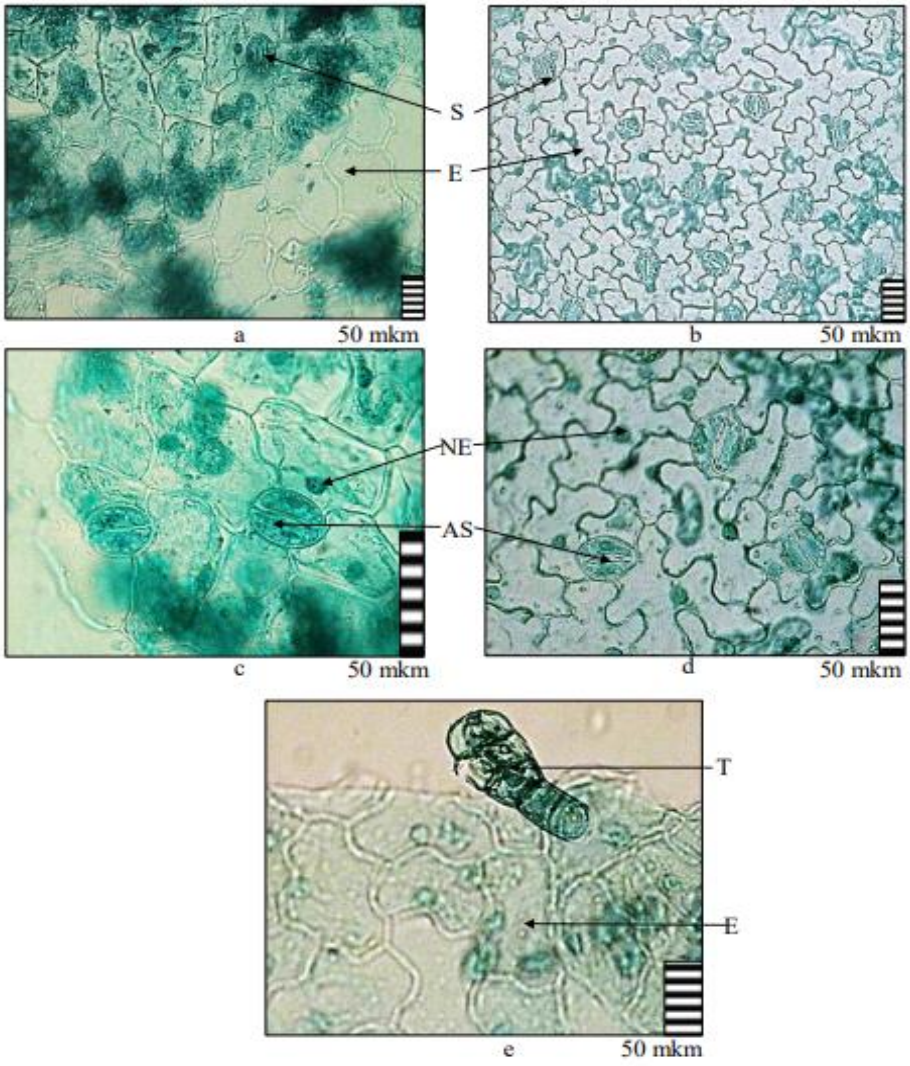

Fig. 7. Anatomical structure of the leaf epidermis of *Lycium barbarum* L.:
a, c – upper (adaxial) epidermis; b, d – lower (abaxial) epidermis; e - trichome.
Symbols: AS - anomocytic type of stomata, S - stomata, E - epidermis,
NE - nucleolus of the epidermis, T - trichome. Magnification - 50-100 micron.

Leaf mesophyll on a cross section is of the dorsiventral type, which is represented by palisade cells located under the upper epidermis of the leaf mesophyll, spongy cells - above the lower epidermis of the leaf mesophyll. The epidermis is represented by a single row of cells with a thick-walled cuticle layer. [28,29,31]. The cells of the adaxial epidermis are larger than those of the abaxial epidermis. Between the adaxial and abaxial epidermis are palisade and spongy parenchymal cells. Beneath the adaxial epidermis lies the palisade parenchyma. The palisade parenchyma is the most chlorophyll-bearing, larger and more elongated, which

consists of one row of cells and is located between the adaxial epidermis and spongy parenchyma of the leaf (Fig. 8).

The spongy parenchyma is chlorophyll-bearing, consists of 4-5 rows and is located between the palisade parenchyma and the abaxial epidermis. The spongy parenchyma is round-oval, large-celled with large cavities. Between the palisade and spongy cells there are numerous lateral vascular bundles, with 2-3 small vessels. Palisade and spongy parenchyma cells are absent, calcium oxalate is in the form of crystalline sand (Fig. 8).

The main leaf vein protrudes on the abaxial side. The rest of the vein is occupied by the main parenchyma, into which one vascular bundle is immersed; parenchyma cells are thick-walled, round-oval in shape, among which hydrocytic cells are found [9].

Conductive bundles are of closed bicollateral type, numerous, consisting of phloem and xylem. Xylems are thick-walled, elongated. Their walls are thickened in the form of spirals (Fig. 8).

The petiole of the leaf on a transverse section of the parenchymal-beam type, consists of a single-row epidermis, numerous parenchyma and vascular bundles. The petiole protrudes on the underside of the leaf. Under the epidermis is a lamellar single-row collenchyma. In the center of the petiole there is 1 vascular bundle. The conducting bundle is closed bicollateral, kidney-shaped, which consists of phloem and xylem. The arrangement of the vessels of the conducting bundle is chain-shaped. Parenchymal cells in the central part of the petiole are thick-walled, rounded, oval and hydrocytic cells are found, also calcium oxalate is found in the form of crystalline sand (Fig. 9).[8]

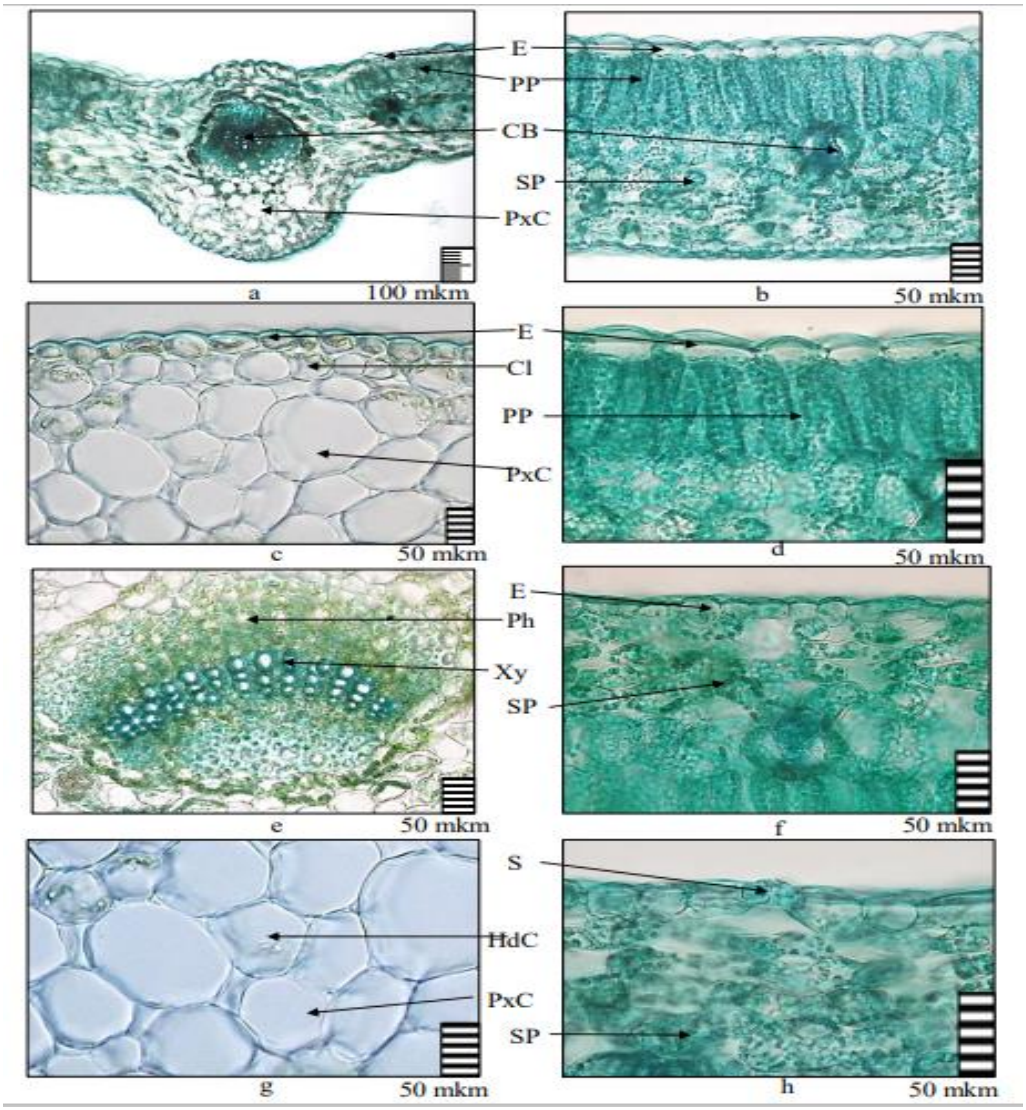

Fig. 8. Anatomical structure of the leaf of *Lycium barbarum* L.:
a - general view of the main vein of the leaf; b – leaf mesophyll; c - epidermis and collenchyma; d - palisade parenchyma; e - conducting beam; f-spongy parenchyma; g - parenchymal and hydrocytic cells; h – non-submerged stomata.
Symbols: HC - hydrocytic cells, SP - spongy parenchyma, Cl - collenchyma, X - xylem,
PP - palisade parenchyma, CB - conducting bundle, PC - parenchymal cells, S - stomata,
Ph - phloem, E - epidermis. Magnification - 50-100 micron.

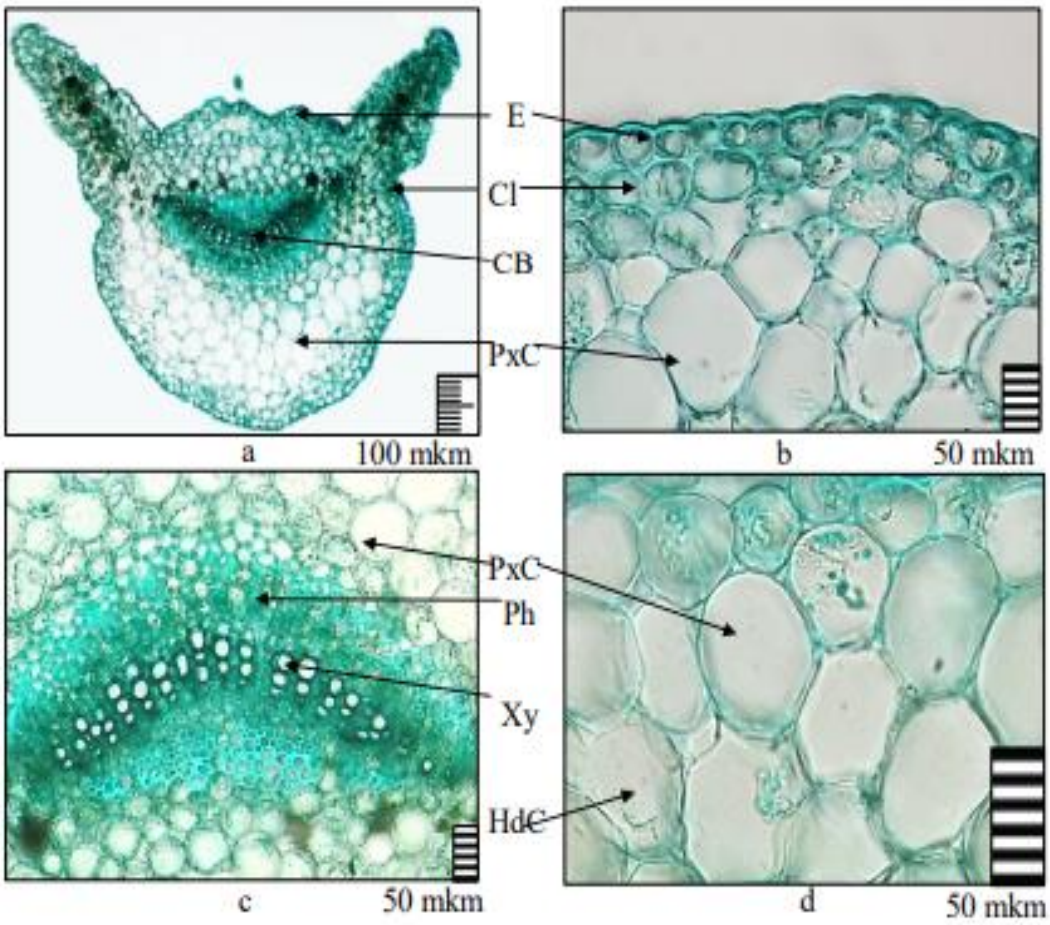

Fig. 9. Anatomical structure of the leaf petiole of *Lycium barbarum* L.:
a – general view, b – epidermis and collenchyma, c – closed bicollateral conducting bundle;
d – parenchymal and hydrocytic cells.
Symbols: HC - hydrocytic cells, Cl- collenchyma, X - xylem, CB - conducting bundle,
PC - parenchymal cells, Ph - phloem, E - epidermis. Magnification - 50-100 micron.

The base of the stem on a transverse section is round-ribbed or square in shape, with a beam type of structure. The anatomical structure of the stem is divided into two topographic zones: the cortical parenchyma and the central cylinder. The costal part of the stem is most sclerified, due to sclerenchyma cells. Sclerenchyma cells consist of 6-7 rows. The epidermis is single row. The primary cortex is often collenchymatous in the outer part, due to collenchymal cells. The cortical parenchyma is round-oval, which consists of 5-6 rows and is preserved throughout. An extensive phloem is located under the cortical parenchyma (Fig. 10).

The wood occupies a solid cylinder surrounding the core, which is located in a central position in the stem. The primary conductive tissues are preserved in the stem, and then the secondary ones immediately form a solid cylinder, which in the cross section looks like an almost continuous ring. With age, the emerging cambium changes the anatomical structure of the stem. It produces secondary xylem (wood) annually. The cambium works more vigorously towards the xylem, pushing the primary xylem toward the core (Fig. 10).

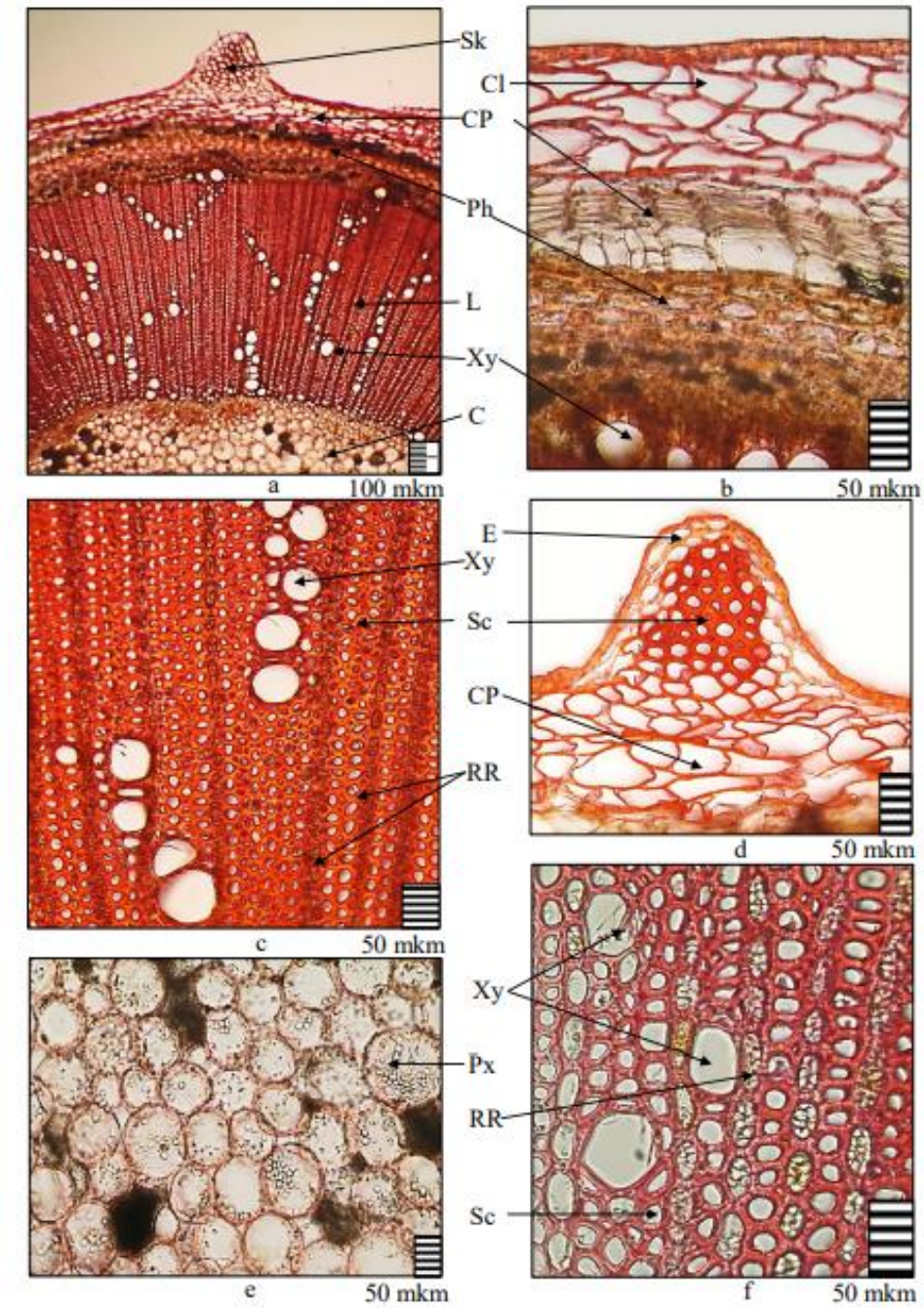

Fig. 10. Anatomical structure of the stem of *Lycium barbarum* L. in cross section:
a – general view of the stem; b – cortical parenchyma; c, f - libriform and secondary conducting bundles; d - costal part of the stem; e - core.
Symbols: HC - hydrocytic cells, CP - core parenchyma, Cl - collenchyma, X - xylem, L - libriform, P - parenchyma, RR - radial rays, C - core, Sc - sclerenchyma, Ph - phloem, E - epidermis. Magnification - 50-100 micron.

The secondary xylem, which occupies most of the section, is easy to identify, since its cells are stained red-brown. It is represented by tracheids arranged in radial rows and few rows, elongated and short medullary rays. The rays are sometimes exceptionally one-sided or with only sparse biseriate rays. Vessels are located in separate inclined groups of vessels that look like annular porous and spiral thickening is observed (Fig. 10).

The intervascular pits on the radial and ligamentous parenchyma are usually simple and elongated, but similar in size and shape to the intervascular fossa. The wood parenchyma is usually sparse and limited to a few cells or a narrow sheath around each vessel; predominantly apotracheal, such as scattered cells or irregular unicavity bands [8].

The core is wide, represented by large and small round-oval, thick-walled parenchymal cells and they contain hydrocytic cells. Calcium oxalate occurs in the form of crystalline sand, noted in the cortical parenchyma and medulla (Fig. 10).

The fruit of *Lyciumbarbarum* L. is an oblong, oblong-ovoid multi-seeded berry, syncarpous with a red or orange veil, 2-celled. On the paradermal section, the outlines of epidermal cells are rectilinear, the projection is rounded. The nucleoli are clearly visible in the cell membranes of the epidermis.

In cross section, the pericarp consists of several layers of large, rounded parenchymal cells. The walls of the outer epidermis are thickened and cutinized. The cells of the outer epidermis are elongated in the radial direction, gradually losing their contents, while their walls thicken and lignify.

In the fruit of mesocarps there are multi-row large parenchymal cells, which are slightly elongated in the tangential direction in the outer layers, and rounded in the inner ones. There is a conducting bundle between the parenchymal cells.

Parenchyma cells around the vascular bundles, especially in the inner part, are small and elongated in the radial direction. Endocarp consists of rather small cells of irregular shape (Fig. 11).

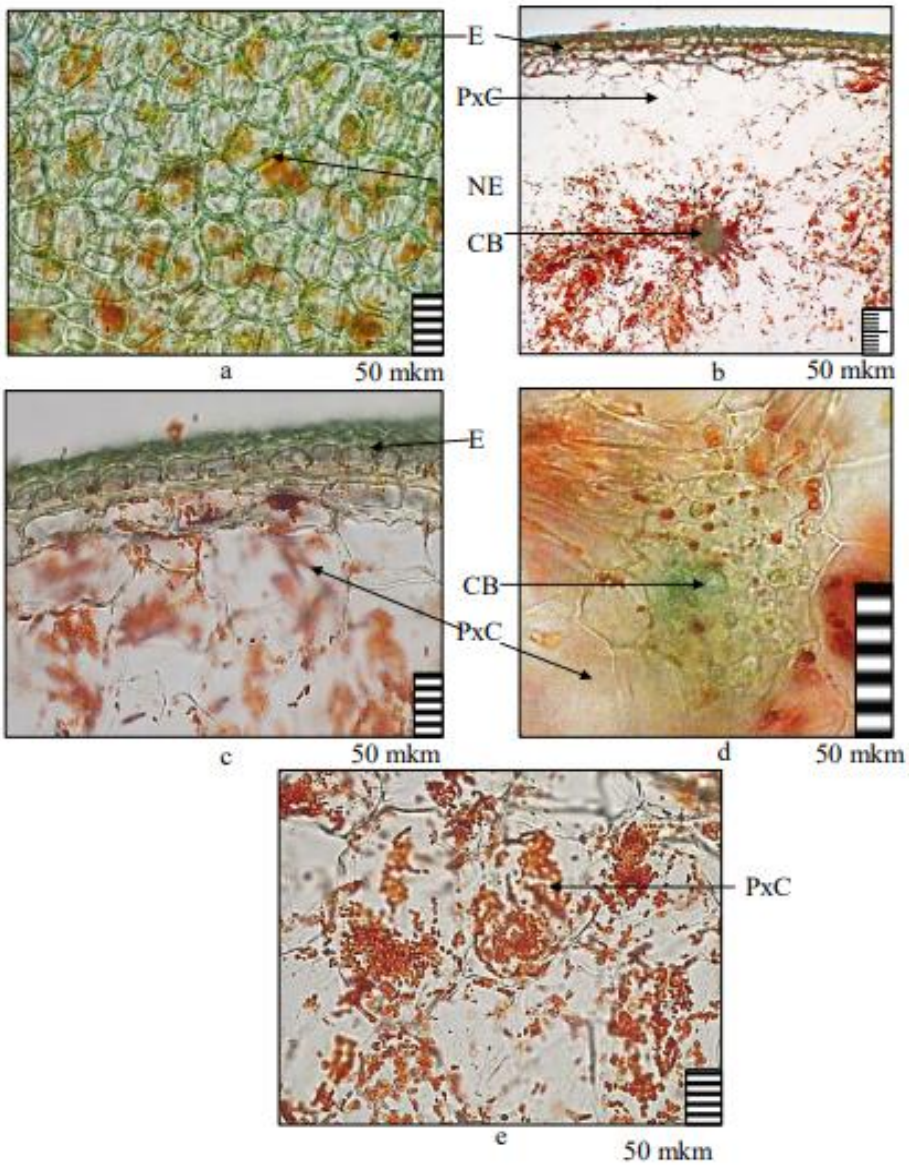

Fig. 11. Anatomical structure of the pericarp of the fruit of *Lycium barbarum* L.:
a – the epidermis of the fruit on the paradermal section; b, c, e – epidermal and parenchymal cells in a cross section; d - conducting bundle.
Symbols: CB- conducting bundle, PC - parenchymal cells, E - epidermis, NE - nucleolus of the epidermis. Magnification - 50-100 micron.

The seeds of *Lyciumbarbarum L.* are large, rounded, flat, reniform-elongated, at the seed hilum more or less elongated into a beak-shaped spout (Fig. 12).

The surface of the seeds is warty-wavy, multifaceted. The coloration is light yellow. On a transverse section, the seed coat consists of the outer epidermis (exotesta), remnants of the integumental parenchyma, and the inner epidermis (endotesta). From the surface, the outer epidermal cells have a sinuous shape, their inner periclinal walls and the inner part of the anticlinal walls are thickened.

In *Lyciumbarbarum* L., the seed coat is formed by cells of the outer epidermis and obliterated layers of cells of the integumental parenchyma. The cells of the outer epidermis receive peculiar thickenings at the base and become lignified.

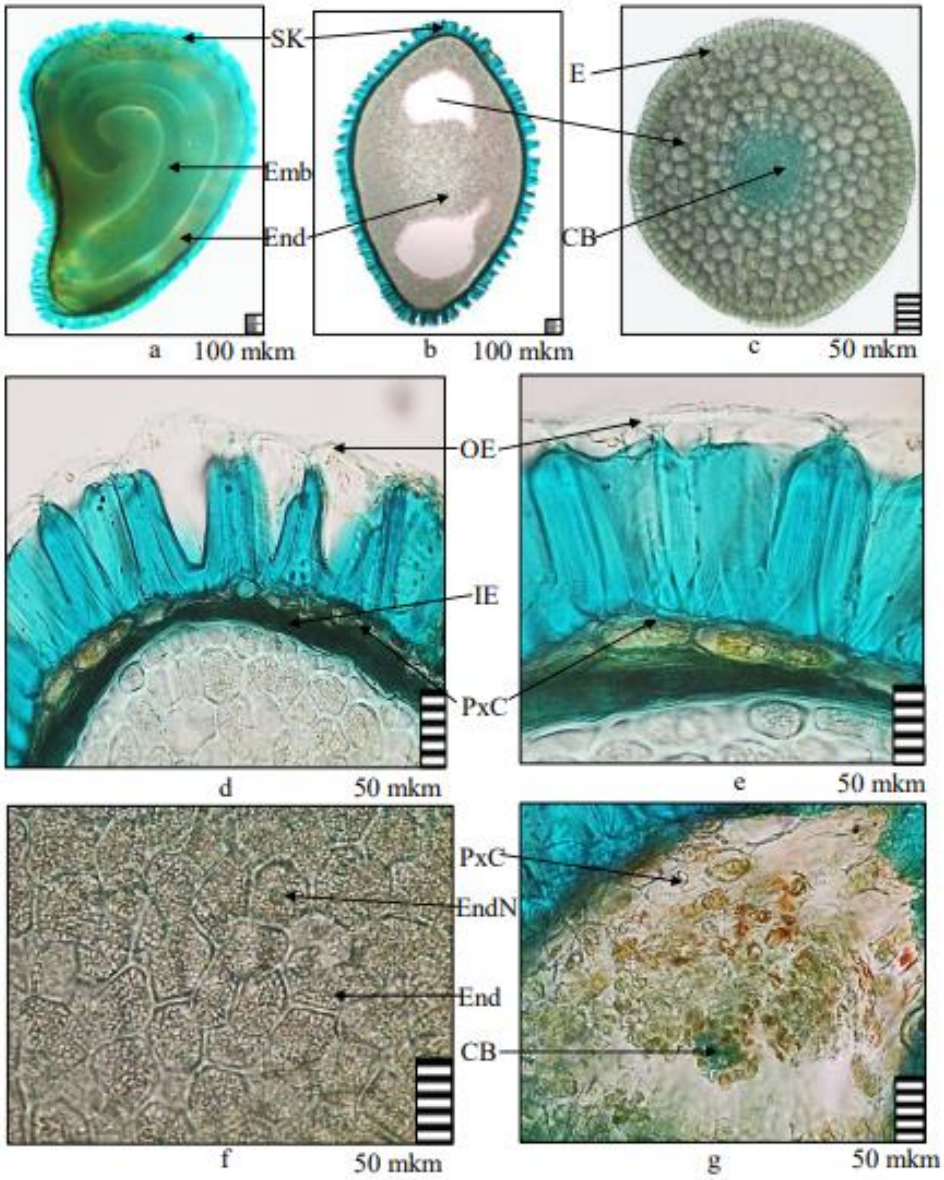

Fig. 12. Anatomical structure of the seeds of *Lycium barbarum* L.:
a – general view of the seeds in a longitudinal section; b - general view of seeds in a cross section; c - spine; d-e - seed peel; f – endosperm; g-parenchyma and conducting bundles.
Symbols: IE - inner epidermis, Emb - embryo, OE - outer epidermis, CB - conducting bundle, PC - parenchymal cells, SC - seed coat, E - epidermis, End - endosperm, EndN - endosperm nucleolus. Magnification - 50-100 micron.

Between the inner and outer epidermis there are strongly compressed remnants of the cells of the parenchyma of the integument. The perisperm is absent. Endosperm is of cellular type. The endosperm consists of large, elongated, tightly closed cells with significantly thickened cell walls.

Endosperm cells contain oil droplets and aleurone grains. Endosperm cells are with prominent nucleoli (Fig. 12).

The embryos are curved, chlorophyll-free, differentiated into two cotyledons, hypocotyl, shoot apex, and radicle. The embryonic cells contain oils and aleurone grains (Fig. 12).

CONCLUSION

For the first time in the conditions of the Tashkent Botanical Garden (Uzbekistan), morphological anatomical and histological studies of the vegetative and generative organs of *Lyciumchinense* and *Lyciumbarbarum* L. were carried out. In palisade, cortical and parenchymal cells, calcium oxalate is found in the form of brown crystalline sand.

In parenchymal cells, the fruit pericarp is marked by the presence of localization of biologically active substances; also, endosperm and embryo cells contain oil drops and aleurone grains. The results obtained made it possible to determine a number of morphological, anatomical, histological and characteristic diagnostic features for these species. These identified diagnostic features can be used in plant systematics, for the identification of plant materials and environmental and geobotanical studies,also for the development of regulatory documentation for raw materials of the genus *Lycium*.

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