MACRO- AND MICROSCOPIC INVESTIGATION OF LEAVES AND FLOWERS CULTIVATED SPECIES GENUS Primula L. – DRUMSTICK PRIMROSE

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Key words: drumstick primrose; leaves; flowers; morphological and anatomical structure

Topicality. Many species of genus Primula L. are valuable medicinal and vitamins plants, but analysis of scientific literature demonstrates a lack of systematic information on morphological and anatomical structure of some species of mentioned genus, especially drumstick primrose, so they still remain objects of investigation as perspective.

The aim of these studies was investigation of morphological and anatomical structure above ground organs of drumstick primrose and establishing macro- and microscopic diagnostic features of plants, that are necessary for identification of new plant raw material.

Materials and methods. The objects of the study were leaves and flowers of drumstick primrose harvested during the plants flowering. Microscopic analysis was performed using commonly accepted methodologies, microscopes MBS 9, MS 10, microphotographs made by the Samsung camera PL50.

Results and discussion. As a result of conducted investigation, it was found: 1. The morphological diagnostic features: leaves without leafstalk, reaches 20-40 cm in length, collected in a dense rossette. Leaf plate wide thick, elongated, on the edge finely serrated, light green, pubescence, wrinkled and lumpy. Thick peduncles, covered at the top by yellowish cilia. Small flowers on short pedicle, gathered in dense spherical umbrella diameter of 4-10 cm; corolla violet, blue, purple, red, pink or white. 2. Anatomical features: Leaf – leaf plate dorsoventral, hipostomatic; upper epidermis without stomata; lower epidermis of anomocytic type; many specialized cells with orange secret; on the edge of the plate located the teeth of secretizing epidermis; lower epiderm densely covered with hairs of two kinds. Peduncles – cylindrical; anatomical structure transition. Primary bark an ulmayer; many secretory cells and milkmen with brown contents; ring of conductive bundles narrow; core parenchyma contains many dark secretory structures. Epidermis covered by capitate glandular hairs. Flower – calyx; stomata and hairs absent; contain frequent dark secretory idioblast, veins with segmented milkmen with a yellowish secret. Corolla with secretory cells.

Conclusions. For the first time, has been conducted investigation of morphological and anatomical structure features of leaves and flowers cultivated species genus Primula L. – drumstick primrose, detected their typical macro- and microscopic diagnostic features, that make it possible to identify the flowers and leaves of this species primrose and that used to develop the project of quality control methods for the new medicinal plant raw material.

Key words: drumstick primrose; leaves; flowers; morphological and anatomical structure
INTRODUCTION

Plants of the family Primulaceae, unfortunately, today is poorly studied. There are only a few works, which presented the botanical descriptions of individual species and information on their practical application [1, 4, 6, 7, 9, 10].

Primula L. largest in the Primulaceae family and accounts, according to various experts, more than 600 species. Types of primroses very diverse by morphological and anatomical features, by the content of biologically active substances, by the application in scientific and folk medicine [1, 2, 4-6, 9, 10]. Many species of genus Primula L. are valuable raw materials, mainly medicinal and vitamins plants, but still they stay objects of investigation as perspective, and many representatives has not yet investigated [1, 2, 6, 9].

Considerable interest makes drumstick primrose (Primula denticulata Smith) – an ornamental plant that attracts by unusual long spherical inflorescences of violet, blue, purple, red, pink or white colors [8].

Drumstick primrose (large flower) (Primula denticulata Smith) – a perennial herbaceous plant. Leaves without leafstalk, reaches 20-40 cm in length, collected in a dense rosette. At the beginning of development, they rolled spiral. Leaf plate light green, juicy, soft from pubescence, wrinkled, lumpy. The main and lateral paralel veins thick, juicy. The shape of the plate wide thick, elongated, on the edge finely serrated, the base gradually narrowed, represented by wide white main vein on the edge of wavy wings. Thick pedicules, at the beginning of flowering 10-15 cm long, covered at the top by yellowish cilia, in fruiting phase up to 40-50 cm, tubular: The flowers on short pedicel, gathered in dense spherical umbrella diameter of 4-10 cm. Corolla violet, blue, purple, red, pink or white. Bend like a wheel, diameter about 1.5 cm. The tube is narrow, longer than the cup. Most flowering in leafless condition. At the beginning of flowering pedicules – no more than 2-3 cm. By the middle flowering blossoms-balls found at a height of 20-25 cm, and on the ripening time seeds, they are extracted to 30-50 cm. Approximately the same happens with the leaves. They begin to unfold at the beginning of flowering, and at this time their length makes 5-7 cm, to the middle flowering blossoms-balls found at a height of 20-25 cm, and on the ripening time seeds, they are extracted to 30-50 cm. Approximately the same happens with the leaves. They begin to unfold at the beginning of flowering, and at this time their length makes 5-7 cm, to the middle of flowering – already 20 c, after flowering in favorable conditions – 30-40 cm. The whole plant, especially the
peduncles are covered with yellowish mealy coating. It flowers from April 30-40 days [8].

Data analysis of scientific literature indicates the absence of systematic information about morphological and anatomic structure of variety, including above ground, organs this plant, so the aim of this work was investigation of morphological and anatomical structure above ground organs of drumstick primrose and establishing macro- and microscopic diagnostic features of plants, that are necessary for identification of new plant raw material.

MATERIALS AND METHODS
For the investigation were used the leaves and flowers of drumstick primrose harvested during the plants flowering (April-May 2015) at the M. M. Gryshko National botanical garden National Academy of Sciences of Ukraine. Microscopic analysis was performed using dried raw materials, fixed in a mixture of alcohol-glycerol-water (1 : 1 : 1) and including liquids of temporary micropreparations – chloral hydrate and glycerol solutions. Investigation of transverse and longitudinal sections, dissected epidermis and preparations from the surface were carried out using commonly accepted methodologies, microscopes MBS 9, MS 10 (eyeglass X5, X10, 15, lenses X10, H40), microphotographs made by the Samsung camera PL50 [3, 11].

RESULTS AND DISCUSSION
Macroscopic analysis of drumstick primrose leaves
The leaves of drumstick primrose are widely oval, elongated on the edge finely serrated, at the base gradually narrowed, with a broad white main vein with wavy wings on the edge, lumpy-wrinkled, pubescent, without petioles, 20-40 cm long. Color of leaves light green on top, at the bottom – a little lighter. The smell peculiar. The taste is bitter, mucous.

Macroscopic analysis of drumstick primrose flowers
The flowers are small, five-membered, two-tube with separate petals, calyx has five teeth on edge. The tube is narrow, longer than the cup. The flowers on short pedi-
cel, collected in dense spherical umbrella with a diameter 4-10 cm. Corolla violet, blue, purple, red, pink or white. Bend like a wheel with a diameter about 1.5 cm. The smell is weak, specific. The taste is sweet.

Microscopic analysis of drumstick primrose
Leaf. Leaf plate pubescent. The basic cells of the lower epidermis (Fig. 1) slightly elongated along the axis of the leaf, the side walls are thin, porous, finely winding, outer shell with soft folds of cuticle. Among ordinary cells many specialized cells that differ by the presence of orange secret. Stomata large, numerical, round, anomocytic type surrounded by 5-6 epidermal cells. Over veins (Fig. 1) narrow epidermis cells, more elongated, almost straight wall. Frequent trichomonas outgrowths of epidermal cells of two types. Small glandular hairs uniformly located, composed with short 1-2-cell legs and small unicellular head with dark content. Also on all surface, and the most densely on veins and along the edge of the plate, are found large, long, live, 3-12-cellsingle row hairs. One or several basal cells large, domed. Medial cell-segments wide, their shells are thin, usually easily distorted. Apical cells form small spherical colorless or dark head and a more or less distinct 1-2-cell narrow neck.

The upper epidermis (Fig. 2) without stomata, with less density of hairs. Basic cell larger, slightly elongated, their side walls slightly wavy or straight, many pores alternating with beads like thickenings. Teeth on the edge of the plate (Fig. 2) with secreting epidermis, densely covered with multicellular long hairs with elevated rosette of thin wall cells. Often several contiguous hairs form a bundle. Veins accompanied articulated milkman (Fig. 2) with bright orange content.

Leaf plate dorsoventral, hipostomatic. Main vein juicy, seems far from the bottom side. In the middle of it part goes the central conductive bundle, and at the place of transition to a leaf plate - 2 or 4 small side bundles (Fig. 3). Around the bundles and among main parenchyma many secretory idioblast of ovular- or rounded-paddle shape with dark content (Fig. 3). Also, meet milkmen with lighter...
secret (Fig. 3). In the protrusion vein subepidermal kolenchyma composed 1-3 layers. Hairs on a vein a lot, they are typical for all above-ground parts (Fig. 3).

Peduncle cylindrical, increasing in diameter and lose core in the downward direction and becomes tubular. Anatomical structure transition. Stem at the top, under inflorescence (Fig. 4) correctly rounded shape, fulfilled by core of parenchyma. Covered by epidermis with a thick, almost continuous ciliary pubescence glandular hairs (Fig. 4), which have 1-2 cell foot and thin-walled oval head with yellow contents. Primary bark multilayer, replete with secretory cells and the milkman with brown contents.

Fig. 2. The upper epidermis and leaf teeth. 1 – epidermal cells; 2 – tooth with pubescence; 3 – multicellular hairs along the edge of the plate; 4 – milkmen along the veins

Fig. 3. Fragments of transverse cut of leaf plate and main veins. 1 – lateral conductive bundles; 2 – the main parenchyma; 3 – conductive central bundle; 4 – milkmen; 5 – secretory idioblast; 6 – kolenchyma; 7 – multicellular hairs

Fig. 4. Preparations of apical zone peduncle and pedicels. 1 – cross-cut peduncle; 2 – epidermis of peduncle with capitate hairs; 3 – primary bark; 4 – phloem; 5 – xylem of conductive bundles; 6 – core with milkman and secretory idioblast; 7 – capitate hairs of pedicels epidermis
This same secret accumulate endoderm cells. Ring of conductive bundles narrow, includes densely placed main larger collateral bundles and between them - a little additional bundles, formed by cambium that placed between the beam. In the bundles phloem merges and xylem forms a triangular protrusion, separated by parenchyma. Among the core parenchyma many dark secretory structures. Pedicels have a similar structure. Capitate hairs of epidermis located uniformly, composed from 1-2-cell thin legs and rounded-oval head.

In the middle and lower zone peduncle become ribbed, epidermis (Fig. 5) without hairs, with oval stomata, placed by longitudinal rows. Epidermal cells elongated, narrow, their joints wedge-shaped. Right away under the
epidermis or the single-layer kolenchym lying and densely connected with it segmented milkmen with a dark content (Fig. 5, 6). They also distributed throughout all primary cortex and the axial cylinder. Changes in the structure of the central cylinder, in compare with apical area, resulting in the formation of multilayer rings of pericycle sclerenchyma, in ceasing the diameter and reducing the width of the conductive rings, increasing the volume of the core and its almost total destruction at the bottom (Fig. 6).

Calyx (Fig. 7A) covered by rectangular elongated epidermal cells with slightly thickened shells. Stomata and hairs absent. In mesophylls, many dark secretory idioblast slightly elongated along the axis of sepals. Veins accompanied by segmented milkmen with a yellowish secret.

Corolla (Fig. 7 B) is also rich for secretory structures. Epidermis of tube make rectangular-rounded cells with a thin shell. Epidermis at bend similar papillary.

**CONCLUSIONS**

1. For the first time has been learned morphological and anatomical structure of drumstick primrose and identified their main macro- and microscopic diagnostic features of over ground organs, that make it possible to identify and standardize new medicinal plan raw material.

2. The morphological diagnostic features: leaves without leafstalk, reaches 20-40 cm in length, collected in a dense rosette. Leaf plate wide thick, elongated, on the edge finely serrated, light green, pubescence, wrinkled and lumpy. Thick peduncles, covered at the top by yellowish cilia. Small flowers on short pedicel, gathered in dense spherical umbrella diameter of 4-10 cm; corolla violet, blue, purple, red, pink or white.

3. Anatomical diagnostic features of drumstick primrose: Leaf – leaf plate dorsoventral, hipostomatic; upper epidermis without stomata, with a lower density of hairs;
basic cells larger than in the lower epidermis; lower epidermis with large, rounded, numerous stomata of anomocytic type; the basic cells of the lower epidermis slightly elongated along the axis of the leaf; among ordinary cells many specialized cells with orange secret; on the edge of the plate located the teeth of secreting epidermis; lower epidermis densely covered with hairs of two kinds.

Peduncles – cylindrical, increases in diameter and lose core in the downstream direction and becomes tubular; anatomical structure transition. Primary bark a multilayer, many secretory cells and milkmen with brown contents; ring of conductive bundles narrow; includes densely placed main larger collateral bundles and between them - a little additional bundles; core parenchyma contains many dark secretory structures. Epidermis covered by capitate glandular hairs.

Flower – calyx covered by rectangular elongated epidermal cells with slightly thickened shells; stomata and hairs absent; contain frequent dark secretory idioblast, veins with segmented milkmen with a yellowish secret. Corolla with secretory cells; epidermis of tube make rectangular-rounded cells with a thin shell; epidermis at bend similar papillary.

Conflicts of Interest: authors have no conflict of interest to declare.