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DETERMINATION OF MACRO- AND MICROSCOPIC DIAGNOSTIC FEATURES OF ANNUAL SUNFLOWER ANTHODIUMS

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For the first time the features of the morphological and anatomical structure of the annual sunflower (*Helianthus annuus L.*) anthodiums have been studied. As a result the diagnostic features of the flowers and leaves of the involucre anthodiums that will be used in standardization of the medicinal plant raw material have been revealed. The macroscopic diagnostic features include the anthodium with two-row, imbricated involucre; two types of flowers – false-ligulate, sexless and bisexual tubular, with 5-teeth pubescent pale yellow corolla swollen at the base. The microscopic diagnostic features include the types of trichomas, their location, the shape of the epidermal cells and pupillas, anomocytic type of the stoma apparatus, the presence of the aerenchyma and schizogenous conceptacles in the involucre leaves, the shape and the sculpture of the pollen grains surface. The research results can be used for identification of the medicinal plant raw material.

Sunflower (*Helianthus annuus L.*) is a bristly pubescent annual plant of the family Asteraceae (*Asteraceae L.*), which is one of the world's most famous agricultural crop. The analysis of the literature indicates the lack of systematic information concerning the study of macro- and microscopic features of the structure of the flowers of the annual sunflower. So, the aim of the research is to study the characteristics of the morphological and anatomical structure of annual sunflower anthodiums. For the first time the features of the morphological and anatomical structure of the annual sunflower (*Helianthus annuus L.*) anthodiums have been studied. As a result the diagnostic features of the flowers and the leaves of the involucre anthodiums that will be used in standardization of the medicinal plant raw material have been revealed. The macroscopic diagnostic features include the anthodium with two-row, imbricated involucre; two types of flowers – false-ligulate, sexless and bisexual tubular, with 5-teeth pubescent pale yellow corolla swollen at the base. The microscopic diagnostic features include the types of trichomas, their location, the shape of the epidermal cells and pupillas, anomocytic type of the stoma apparatus, the presence of the aerenchyma and schizogenous conceptacles in the involucre leaves, the shape and the sculpture of the pollen grains surface. The research results will be used in standardization of the medicinal plant raw material.

Sunflower (*Helianthus annuus L.*) is a bristly pubescent annual plant of the family Asteraceae (*Asteraceae L.*), which is one of the world's most famous agricultural crop [2, 3, 9].

In folk medicine, the marginal flowers and the leaves have long been used in treating jaundice, heart disease, bronchial spasms, flu, catarrh of the upper respiratory tract, gastrointestinal colics, malaria. Alcohol tinctures made of the marginal flowers and leaves are effective in fever, malaria, neuralgia. The decoction made of the above mentioned raw material is recommended as a diuretic and antidiarrheal remedy [3].

The analysis of the literature indicates the lack of systematic information concerning the study of macro- and microscopic features of the structure of the flowers of the annual sunflower [5, 6, 7, 8, 10, 11, 12].

The aim of the research was to study the characteristics of the morphological and anatomical structure of annual sunflower anthodiums.

Materials and Methods

The raw material for research were prepared in the phase of full blossoming (June 2012) in Kharkiv region, Kharkiv area, town Bezlyudovka. The general signs of the flowers and leaves of the involucre were studied with a magnifying glass with magnification x3 and with a stereoscopic microscope «MBS-9» (magnification 3,33-100 times); the anatomical structure of the flowers and leaves of the involucre were analyzed in cross sections and specimens from the surface by the established procedure [1, 4]. The study was performed using a microscope «Biolam-70» and «PB-2610» with magnification of 100, 120, 400 and 600. The data were photographed by a Sony DSC-W510 camera. The photographs were processed by a computer program «Photoshop CS5».

Results and Discussion

Inflorescence is a multiflorous, drooping anthodium with the diameter of 20-40 cm. The involucre is imbricated, distichous, has ovate, acuminate pubescent leaves. The general bed of the anthodium is flat. The marginal flowers are 4-6 cm long, false-ligulate, sexless, bright yellow, sometimes with an underdeveloped pistil. The calyx comprises 2 subulate scales. In the centre of the anthodium there are numerous bisexual tubular flowers (up to 1000) with a five-teethed, pale yellow corolla, pubescent and swollen at the base. There are five stamens with adnate into a tube blackish anthers and short free stamen filaments. The pistil has a lower unilocular ovary and two-laciniate stigma.

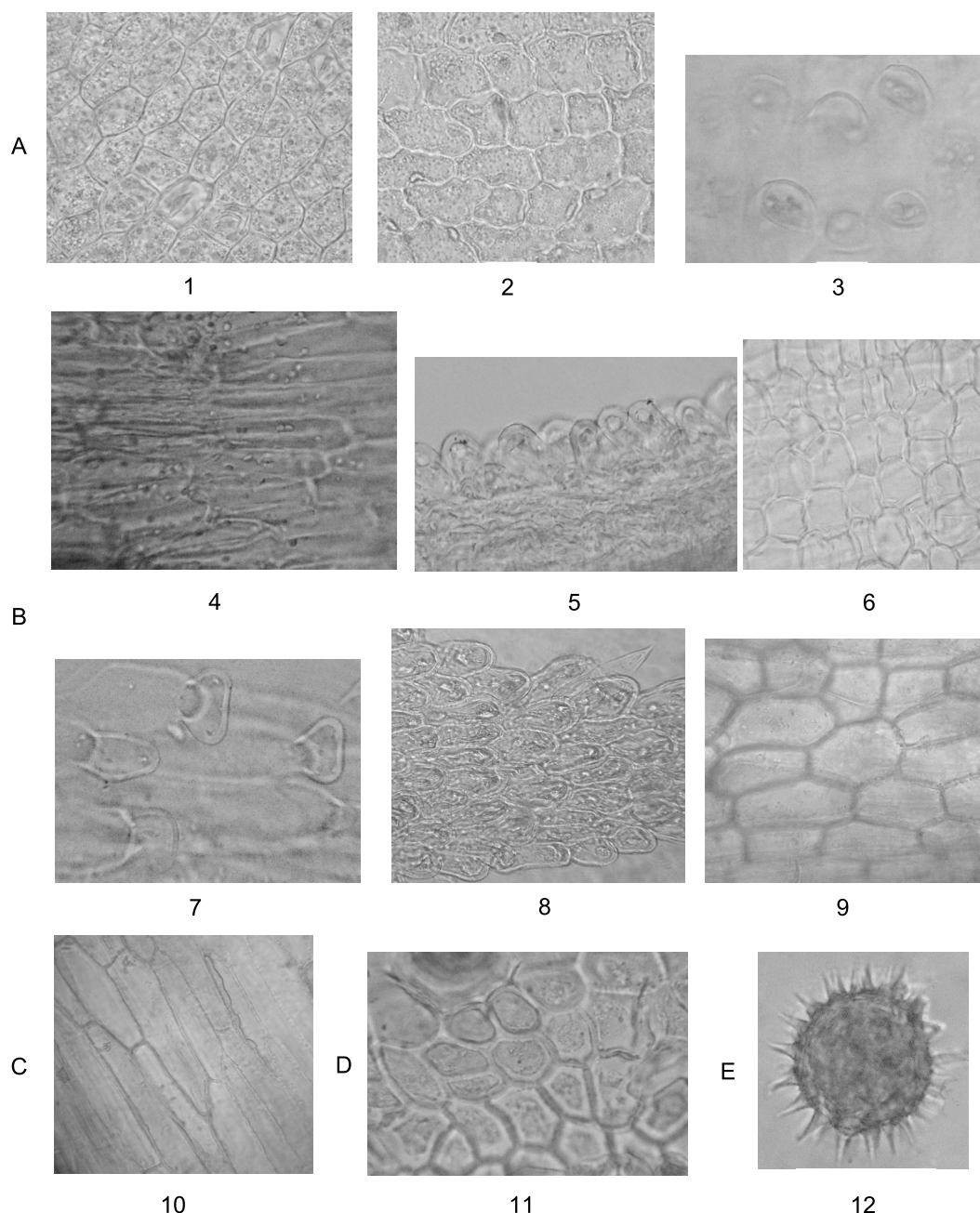


Fig. 1. The microscopic features of flowers of annual sunflower. A. False-ligulate flowers: 1 – the upper epidermis, 2 – the lower epidermis, 3 – the papillas. B. The tubular flowers: 4 – the external epidermis, 5 – the papillas of the external epidermis, 6 – the internal epidermis, the papillas, 7 – of the internal epidermis, 8 – of the tip. C. The bracts: 9 – the cells of the epidermal base, 10 – the cells of epidermis from the centre to the top; D. The involucre: 11 – the epidermis, E. Pollen: 12.

The upper epidermis of false-ligulate flowers is composed of parenchymatous, thin-walled, multiangular cells (Fig. 1. A.1). The lower epidermis at the base of the flower is represented with parenchymatous cells with slightly sinuous uniformly thickened walls (Fig. 1. A.2), closer to the top they are more elongated, wall-sided. At the base of the flower papillary outgrowths of the epidermis with roundish tops are well expressed (Fig. 1. A.3). The stomas of the anomocytic type is very rare on the upper and the lower epidermis. (Fig. 1. A.1). The false-ligulate flowers are pubescent roughly, they are more densely on veins and at the base of the flower. On the both sides the degree of pubescence gradually decreases from the base to the top. There are 4-6-cellular hairs with a pointed top (Fig. 2.5), and at the base of the flower

on the external epidermis there are also 2-cellular hairs (Fig. 2.1) and 3-cellular hairs with collapsed medium cells (Fig. 2.2).

The cells of the external epidermis of tubular flowers are prosenchymatous, wall-sided (Fig. 1.B.4); of the internal one are parenchymal, thin-walled, with plenty of angles (Fig. 1. B.6), those close to the veins are elongated. The vessels of veins are spiral. The stomas are absent. The epidermis on the both sides of the corolla is densely covered with papilla outgrowths (Fig. 1. B.5), which are covered with a folded cuticle. From inside these outgrowths have three forms of the top: round, capitated and extended, daedalous (they are met rarer) (Fig. 1. B.7). Tubular flowers are densely pubescent, with hairs often found on the outer epidermis at the

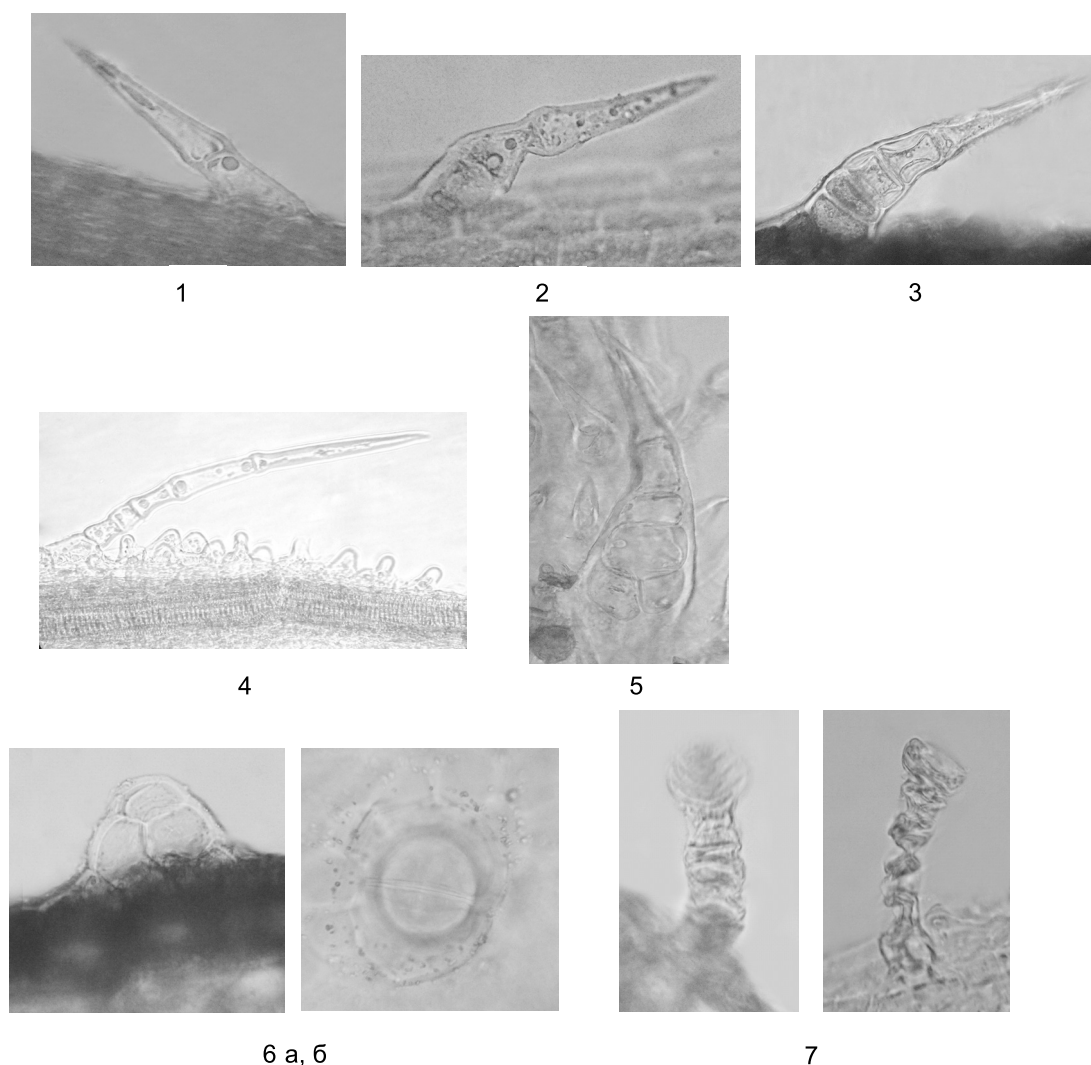


Fig. 2. The types of trichomas of annual sunflower. Covering hairs: 1 – 2-cellular hair, 2 – 3-cellular hair, 3 – 6-cellular hair, 4 – 5-cellular hair, 5 – 6-cellular simple hair with 2-cellular base and pointed top, 6 – tuberosus hair (a – a view of the cross-section, b – a view from the surface). Glandular hairs 7 – capitated 7-cellular hair with cells that are collapsed.

base of the flower and on the top. Simple 2-3-cellular hairs with the acuminate top (Fig. 2.1), 6-cellular simple hairs with a 2-cellular base and the acuminate top (Fig. 2.5), as well as capitated 7-cellular hairs with pubescent cells are typical (Fig. 2.7). Closer to the centre the pubescence is represented with rare 3-4-cell simple hairs with the acuminate top (Fig. 2.2). At the base the flower is richly pubescent with three types of hairs: more often with 5-6-cellular simple hairs (three basal cells are rounded, the top is acuminate) (Fig. 2.3); 5-cellular capitated hairs are rare (Fig. 2.7). On the both sides there are covering 2-3-cellular hairs with the acuminate top, 6-7-cellular hairs (Fig. 2.4), and 7-9-cellular capitated hairs with cells, which are collapsed (Fig. 2.7).

The external and internal epidermis of bracts is presented with parenchymatous, multiangular cells at the base (Fig. 1. C.9) and prosenchymatous cells with thickened cell walls as beads in the central and upper parts (Fig. 1. C.10). The stomas are not observed. Pubescence is only on the edge, and it is represented with 3-5-cell simple hairs with the elongated top cell (Fig. 2.2).

The cells of the internal and external epidermis of involucre are parenchymatous, multiangular with thickened

cell walls (Fig. 1.D). Pubescence is represented with three types of trichomas: simple multicellular hairs with three short basal cells (Fig. 2.3), long hairs, which have short basal cells, and the upper ones that are elongated (Fig. 2.4); simple multicellular hairs with pubescent cell walls (Fig. 2.7). The last two types are more common on the edge of the involucre. On the both sides, but most often on the external one, papillous 3-cellular hairs are existed (Fig. 2.6 (a, b)). On the cross-section of the involucre leaves the cortex parenchyma is clearly visible. It is more densely near the upper epidermis and aerenchyma, which is adjacent to the lower epidermis. Towards the upper epidermis there are schizogenous conceptacles of different diameters and vascular bundles.

The column of the pistil is bare, blades are covered with abundant elongated papillas.

The external epidermis of stamen anthers are represented with prosenchymatous thin-walled, straight walls cells. On the surface there are simple 2-4-cellular hairs with the acuminate top (Fig. 2.1).

The pollen grains is of a spherical shape with three strias (Fig. D.1). The strias are short with jagged edges, they often have invisible contours with blunt ends. The

grains are oval, equatorially elongated. The sculpture is thorny. The spikes with acuminate ends are located regularly. The pollen is golden brown.

CONCLUSION

1. For the first time the features of the morphological and anatomical structure of the annual sunflower anthodiums have been studied.

2. The macroscopic diagnostic features include the anthodium with two-row, imbricated involucre; two types

of flowers – false-ligulate, sexless and bisexual tubular, with 5-teeth pubescent pale yellow corolla swollen at the base.

3. The microscopic diagnostic features include the types of trichomas, their location, the shape of the epidermal cells and pupillas, anomocytic type of the stomatal apparatus, the presence of the aerenchyma and schizogenous conceptacles in the involucre leaves, the shape and the sculpture of the pollen grains surface.

REFERENCES

1. Барыкина Р.Н., Веселова Т.Д., Девятков А.Г. и др. *Справочник по ботанической микротехнике. Основы и методы.* – М.: Изд-во МГУ, 2004. – 312 с.
2. Добрачаева Д.Н., Котов М.И., Прокудин Ю.Н. и др. *Определитель высших растений Украины / Под ред. Ю.Н.Прокудина.* – 1-е изд. – К.: Наукова думка, 1987. – 545 с.
3. Ильина Т.А. *Лекарственные растения России: иллюстр. энциклоп.* – М.: Эксмо, 2006. – 168 с.
4. Сербин А.Г., Картамасова Л.С., Руденко В.П. и др. *Атлас по анатомии растений (растительная клетка, ткани, органы).* – Х.: Колорит, 2006. – 86 с.
5. Alkio M., Grimm E. // *J. of Experimental Biol.* – 2003. – Vol. 54, №381. – P. 345-348.
6. Dashek W.V. *Methods in Plant Electron Microscopy and Cytochemistry.* – New York: Humana Press, 2000. – 301 p.
7. Evert R.F. *Esau's Plant Anatomy.* – New York: Wiley-Interscience, 2006. – 602 p.
8. Ferjani E., Jouili H. // *Comptes Rendus Biologies.* – 2003. – Iss. 7. – P. 639-644.
9. Kocjan Ačko D. // *Actaagriculturae Slovenica.* – 2008. – Vol. 91. – P. 1854-1941.
10. Mantese A.J., Medan D., Hall A.J. // *Ann. Bot.* – 2006. – Vol. 97. – P. 999-1010.
11. Rudall P.J. *Anatomy of Flowering Plants.* – New York: Cambridge University Press, 2007. – 146 p.
12. Tyler J., Davis R. // *Ann. of Bot.* – 2006. – Vol. 97. – P. 177-193.

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ОПРЕДЕЛЕНИЕ МАКРО- И МИКРОСКОПИЧЕСКИХ ДИАГНОСТИЧЕСКИХ ПРИЗНАКОВ КОРЗИН ПОДСОЛНЕЧНИКА ОДНОЛЕТНЕГО

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Впервые изучены особенности морфологического и анатомического строения корзинок подсолнечника однолетнего (*Helianthus annuus L.*). Установлены общие и индивидуальные морфолого-анатомические признаки сырья. Выявлены диагностические признаки цветков и листочков обертки корзинок. К макро- и микроскопическим диагностическим признакам отнесены: корзинка с двухрядной черепитчатой оберткой; два типа цветков – ложноязычковые бесполое и трубчатые обоеполое с пятизубчатым опушенным и вздутым у основания бледно-желтым венчиком. К микроскопическим диагностическим признакам отнесены: типы трихом, их расположение, форма клеток эпидермы и сосочковидных выростов, аномоцитный тип устьичного аппарата, наличие аэренхимы и схизогенных вместилищ в листочках обертки, форма и скульптура поверхности пыльцевых зерен. Результаты исследований будут использованы при стандартизации лекарственного растительного сырья.

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ВИЗНАЧЕННЯ МАКРО- ТА МІКРОСКОПІЧНИХ ДІАГНОСТИЧНИХ ОЗНАК КОШИКІВ СОНЯШНИКА ОДНОРІЧНОГО

Я.С.Кічимасова, Т.М.Гонтова, О.О.Соколова

Вперше вивчені особливості морфологічної та анатомічної будови кошиків соняшника однорічного (*Helianthus annuus L.*). Встановлені загальні та індивідуальні морфолого-анатомічні ознаки сировини. Виявлені діагностичні ознаки квіток та листочків обгортки кошиків. До макро- та микроскопічних діагностичних ознак віднесено: кошик з дворядною черепитчастою обгорткою; два типи квіток – несправжньоязичкові безстатеві та двостатеві трубчасті з п'ятизубчастим опушенням та здутим біля основи блідо-жовтим віночком. До микроскопічних діагностичних ознак віднесено: типи трихом, їх розташування, форма клітин епідерми та сосочкоподібних виростів, аномоцитний тип продигового апарату; наявність аеренхіми та схизогенних вмістищ у листках обгортки; форма та скульптура поверхні пилкових зерен. Результати досліджень будуть використані при стандартизації лікарської рослинної сировини.