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## **«PLANTA+. НАУКА, ПРАКТИКА ТА ОСВІТА»**

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## COMPARISON OF MORPHOLOGICAL AND ANATOMICAL CHARACTERISTICS OF TWO SPECIES OF THE GENUS *ARTEMISIA* L. IN UKRAINE

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Key words: species of the genus *Artemisia*, raw materials, epidermis, diagnostic features.

**Introduction.** There are about 500 species of the genus *Artemisia* worldwide. It is one of the largest genera in the Asteraceae family. According to different sources, 20-30 species are represented in Ukraine. The State Pharmacopoeia of Ukraine includes one species – *A. absinthium* L. [2]. No less valuable representative of this genus is *A. argyi* H. Lév. & Vaniot, included in four East Asian pharmacopoeias, which has intensively been spreading on the territory of Ukraine since 1990.

Species of the genus *Artemisia* have been used to normalize digestive and stomach functions, to stimulate heart, to improve memory and as antidepressants for a long time [4]. *A. absinthium* extract has a high content of phenolic compounds and flavonoids. They exhibit anthelmintic and antioxidant activity in animals infected with parasites by neutralizing free radicals and toxins in the blood [7]. Due to the presence of sesquiterpene lactones, flavonoids, phenolic acids and tannins, *A. absinthium* as well as *A. argyi* is used as an immunomodulator [6]. The positive effect of *A. argyi* on the treatment of Alzheimer's disease was revealed in the traditional Chinese medicine [8].

Many morphological, anatomical, palynological and biochemical studies have been made to identify the characteristics of the medicinal plants of the genus *Artemisia*. However, identification of species in the analysis of raw materials has a number of specific features. Such features do not allow to analyze the complex of morphological characteristics. For qualitative analysis of a batch of raw materials, it is important to have some information about the main species-specific morphological and anatomical features of raw organs. Summary data regarding such characteristics of medicinal species of *Artemisia* with corresponding illustrations are absent. Since leaves

predominate in raw materials of species of the genus *Artemisia*, our research focuses on micromorphological features of their epidermis.

**Materials and methods.** The object of study is the leaves of *A. absinthium* and *A. argyi*. The main target of the study has been the search for species-specific epidermal features of the species.

This researches is based on materials and results of long-term field expeditions of the authors in different localities, as well as on cameral processing of results, critical analysis of literary sources and herbarium samples deposited in the National Herbarium of Ukraine. At least 10 samples of each species were studied for morphological and anatomical analysis of the raw material. Fragments of leaves were taken from the samples. They were boiled in water or 5% sodium hydroxide solution for 2-5 min. Preparations for light microscopy were also made prepared [1]. Photographs were made an Olympus CX23 light microscope, a Philip Harris stereomicroscope, and Levenhuk M1000 PLUS camera software. Diagnostic features of model species were carried out by means of a LEM scanning electron microscope, JSM-6060LA, according to the standard technique.

**Results and discussion.** The characteristics of leaf epidermal cells play a leading role in the identification of raw materials of different plant species of the genus *Artemisia*. Microscopic analysis of the leaf surface of the studied *Artemisia* species shows that the epidermis of *A. absinthium* and *A. argyi* are characterized by a number of common features.

The leaf epidermal cells of *A. absinthium* and *A. argyi* are characterized by an irregular shape with wavy walls and a predominantly smooth cuticle. The tortuosity of the cell walls of the abaxial epidermis is greater than that of the adaxial epidermis. The leaf lamina of *A. absinthium* is amphistomatic with a small density of stomata on the adaxial epidermis compared to the abaxial one.

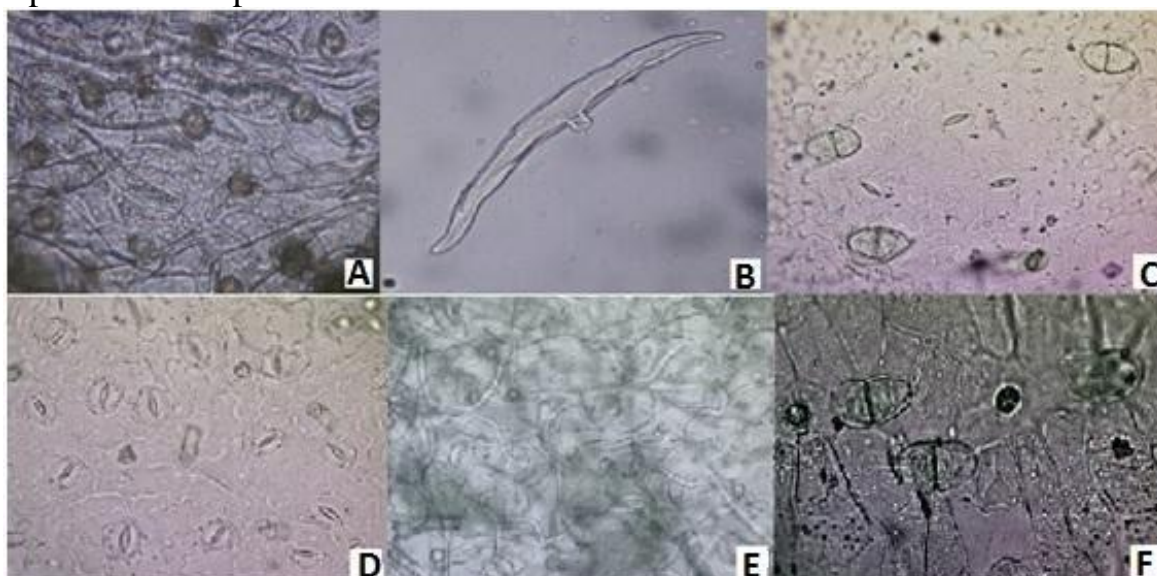


Fig.1. Diagnostic features of *A. absinthium* leaf epidermis (LM):

- A – stomata and non-lesional trichomes on adaxial epidermis x 1000; B – T-shaped trichome x 1000; C – biserial glands on abaxial epidermis x 400; *A. argyi* (LM):  
D – abaxial epidermis x 400; E – abaxial epidermis with T-shaped trichomes x 400,  
F – biserial glands on adaxial epidermis x 400.

Leaves of *A. argyi* are hypostomatic with numerous stomata only on the lower epidermis. Stomata are absent on the upper epidermis. Anomocytic stomata are rounded with 3-6 side cells (Fig.1. A, D; Fig.2 B, F). Stomatic cleft in *A. absinthium* is 17-20  $\mu\text{m}$  long, in *A. argyi* – 13-23  $\mu\text{m}$  long.

Several morphotypes of glandular and non-glandular trichomes were found on the leaf epidermis of *A. absinthium* and *A. argyi*. Of the glandular ones, biserial trichomes predominate on leaves. They are multicellular, differentiated into basal, basic, and apical cells. The synthesis and storage of various types of secondary metabolites take place in them, the best known of which are terpenoids and flavonoids.

In *A. absinthium* and *A. argyi*, the biserial trichomes are heart-shaped. They consist of 8 cells densely placed in two vertical rows: two basal cells "embedded" in the epidermis, four subapical cells, and two apical cells with a subcuticular sac into which secretory compounds are secreted (Fig.1. C, F; Fig. 2 A, C, E, F, G). These glands are 25-50  $\mu\text{m}$  long in the frontal plane in *A. absinthium* and 28-57  $\mu\text{m}$  in *A. argyi*. They are localized in recesses of adaxial (especially in *A. argyi*) and abaxial epidermis under a dense layer of T-shaped non-glandular trichomes.

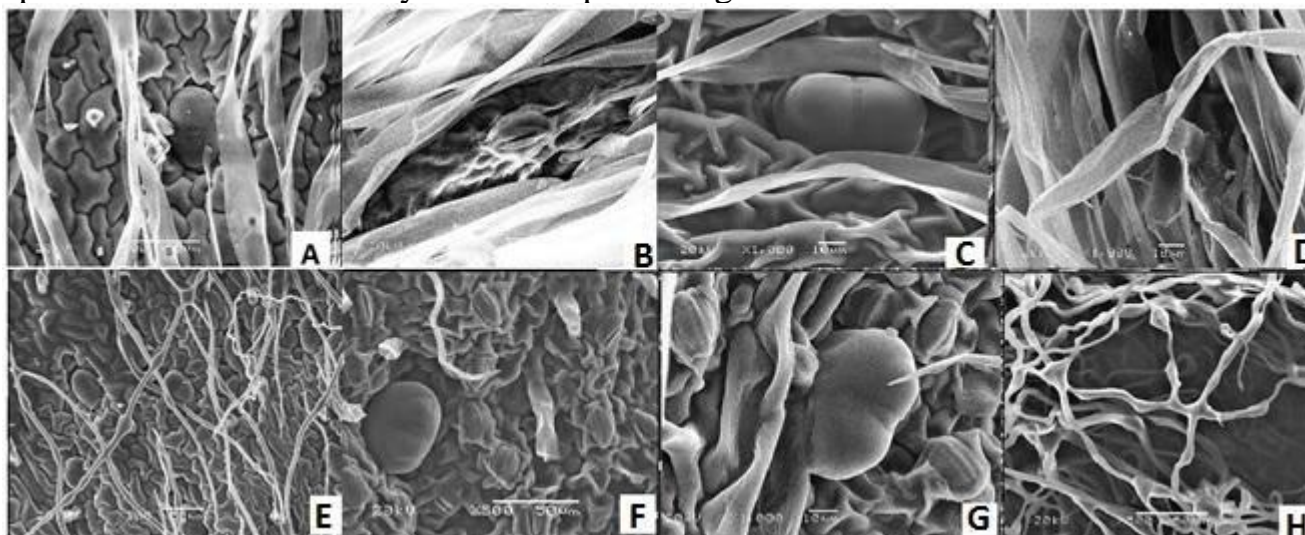


Fig. 2. Diagnostic features of *A. absinthium* leaf epidermis (LEM): A – adaxial epidermis; B – stomata on the abaxial epidermis; C – biserial glandular trichome; D – T-shaped trichoma; *A. argyi* (LEM): E – glandular and non-glandular adaxial epidermal trichomes; F – stomata and glandular trichomes on the abaxial epidermis; G – biserial gland; H – terminal cells anastomoses of T-shaped trichomes.

Densely spaced on leaves filamentous and non-glandular T-shaped trichomes are no less important diagnostic features of raw materials of the genus *Artemisia* (Fig.1. B, E; Fig.2 D, H). Being on the same level as the epidermal cells is a common feature of these trichomes. Their base is slightly convex, in contrast to the glandular ones, which are usually immersed in the epidermis. These trichomes have a terminal cell elongated in parallel with the epidermal surface. It has the shape of a compass needle and a stem base. The stem base is formed by 1-4 cells of *A. absinthium* and 2-3 cells with a thickened basal cell of *A. argyi*. The presence of a wide and long ribbon-shaped terminal cell with a saucer-shaped cavity at the place of attachment to the stem part is a characteristic feature of the T-shaped trichomes of *A. absinthium*. The places of

attachment to the epidermis are in the form of rounded rolls. Trichomes are located predominantly unidirectionally. They densely cover the leaf blade on both sides with greater density on the abaxial epidermis.

**Conclusion.** The studied species of the genus *Artemisia* (*A. absinthium* and *A. argyi*) are characterized by a set of similar macro- and micromorphological features: plant habitus, inflorescence shape, presence of biseriate glandular trichomes, epidermal cell shape. At the same time, the complex of diagnostic characteristics: the location of stomata, the size of the stomatal slit, the structure and localization features of glandular and non-glandular trichomes of the leaf – allow the raw material of each of the analyzed species to be clearly identified.

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#### BIOACTIVE COMPOUNDS FROM SAFFRON FLOWERS

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