

Research Article

Determination of *Verbascum songaricum* Schrenk Morphological and Anatomical Characters

Balzhan G. Makhatova^{1*}, Baurzhan Makhatov², Ubaidilla Datkhayev¹, Daniela Tekelova³,
Toygul Serikbayeva²

¹Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan

²South Kazakhstan State Pharmaceutical Academy, Shymkent, Kazakhstan

³Comenius University in Bratislava, Slovakia

Available Online: 9th June, 2016

ABSTRACT

Verbascum songaricum Schrenk is traditionally used in Kazakh folk medicine from ancient times for the treatment of various diseases. The article presents the results of determination of morphological and anatomical characters of *Verbascum songaricum* Schrenk, Scrophulariaceae family, growing in Kazakhstan were identified using microscopy methods. The results obtained may be used to develop the characteristics of the authenticity of medicinal plants.

Keywords: *Verbascum songaricum* Schrenk, microscopy, trichomes.

INTRODUCTION

Verbascum songaricum Schrenk - biennial plant of the genus *Verbascum* L., which belongs to the family Scrophulariaceae. Scrophulariaceae family includes 360 species, mainly distributed in Asia, Europe and North America¹. *Verbascum songaricum* is widespread in Central Asia, the Caucasus and Iran². On the territory of Kazakhstan is found in Semipalatinsk forest, on the peninsula Mangyshlak, Moyun Kum, the Altai and Tarbagatay, Jungar, Zailiyskiy, Kirghiz and Kungei Alatau, Western Tien Shan, Chu-Ili mountains and Karatau. According to various sources, mullein has been known since ancient times as a medicinal herb. Medieval Arab philosopher Abu Ali Ibn Sina recommended using mullein for the treatment of various diseases. In particular, the decoction of the flowers Avicenna recommended for the treatment of tumors, and a decoction of the aerial parts (herb) - with tears of muscles, for the treatment of chronic cough, inflammation of the eye, and to quench toothache. Medical bandages made from crushed mullein flowers into powder and mixed with honey, Avicenna recommended applying for the treatment of skin wounds and ulcers³. Various application of leaves, flowers and roots of *Verbascum* species to treat respiratory infections, eczema, rheumatism and various wounds was described in the works of researchers from Turkey⁴. *Verbascum songaricum* is widely in the traditional Kazakh people medicine for the treatment of respiratory diseases, various inflammations and hemorrhoids. Despite its widespread on the territory of Kazakhstan and its use in folk medicine from ancient times, morphological and anatomical structure and chemical composition of plant are studied poorly. In this context, the aim of our research is to



Figure 1: *Verbascum songaricum* Schrenk



Figure 2: *Verbascum songaricum* Schrenk flowers



Figure 3: *Verbascum songaricum* Schrenk leaves



Figure 4: *Verbascum songaricum* Schrenk flower

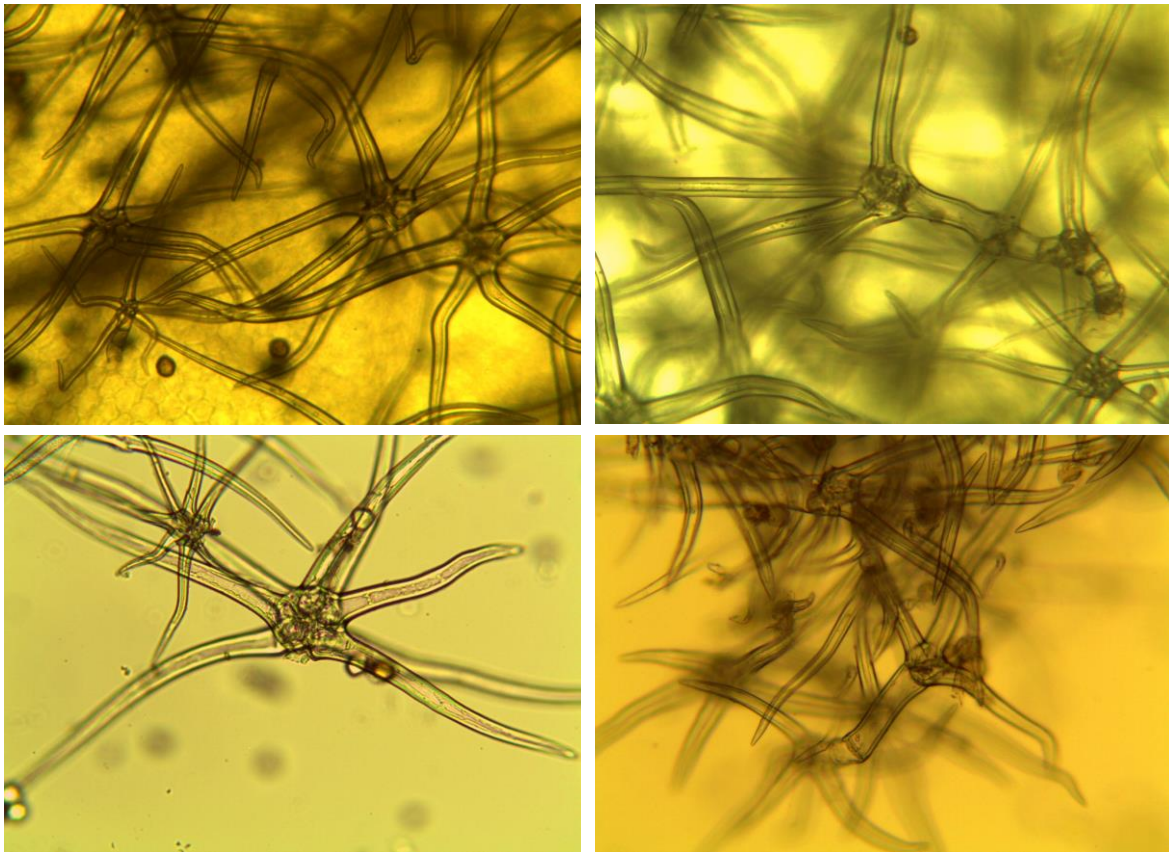


Figure 5: Trichomes from the corolla

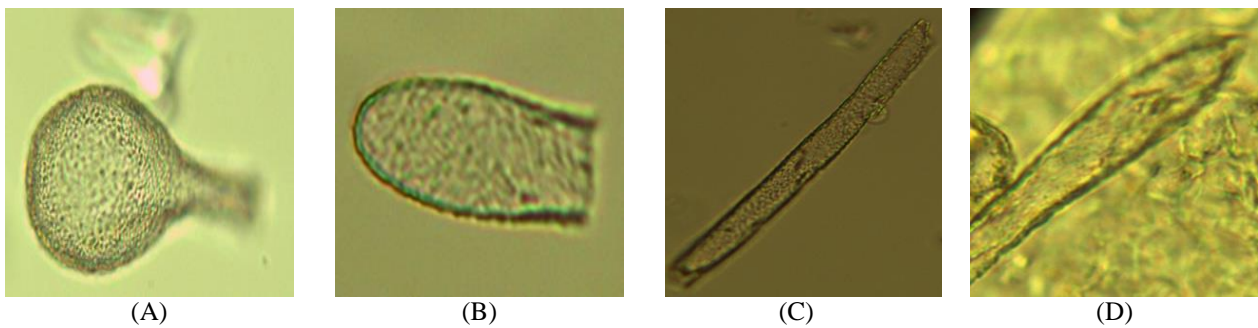


Figure 6: Trichomes from the stamen filaments with a club-shaped (a, b) or a sharp (d) tip

determine the *Verbascum songaricum* morphological and anatomical characters.

MATERIALS AND METHODS

The object of this study is *Verbascum songaricum* raw material, collected in June 2014 in the South Kazakhstan region in Kaskasu gorge. Anatomical studies were performed in accordance with the State Pharmacopoeia of



Figure 7: Pollen grains

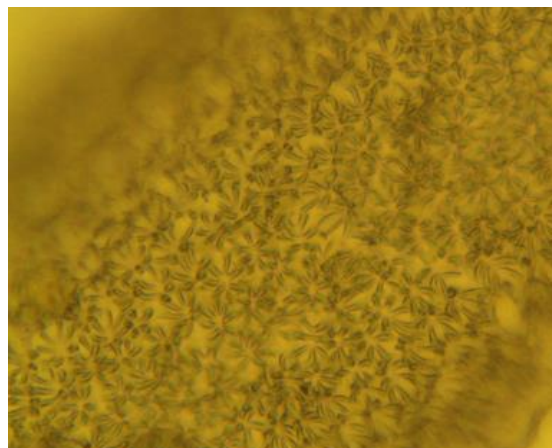


Figure 8: Fragments of the fibrous layer of the anther



3

Figure 9: Fragments of corolla epidermis

the Republic of Kazakhstan⁵. Freshly collected raw material was fixed in 70% ethyl alcohol. Herbarium previously soaked in a mixture of alcohol, glycerin and water, taken in equal proportions. Studies performed with trinocular microscope Leica DME, digital camera Leica EC 3 Mpix, Leica application suite 2.4.0 R1, and lens Leica EZ 4D Digital (Germany).

RESULTS AND DISCUSSIONS

During microscopic study of *Verbascum songaricum* following diagnostic features were identified. Stem is pentahedral; upright, leafy, more branched in the upper part, tomentose. Leaves entire, basal leaves are sessile, some on short petioles, oblong-lanceolate, narrowed to the base of the wedge-shaped, long and wide 10-40sm 3-11sm, greenish-brown top, to the bottom is whitish-green, on both sides densely tomentose (Figure. 3). Inflorescence length is 20-40 cm, and raceme is pyramidal-paniculate. Calyx length 5-8 mm, divided almost to the base in a triangular-lanceolate share and white pubescent. Corolla is 25-35 mm in diameter, yellow, the corolla lobes are densely hairy on the outer surface, glabrous on the inner surface, with a fine network of light brown veins, five-blade; 3-6 flowers in bunches, contiguous with each other; bracts of lower flowers are cordate-rounded, with short tip, the rest broadly; pedicels are short, each bundle with two ovate bracts; five stamens with short hairs, anthers are all the same, kidney-shaped; to the top of the column

thickened (Fig. 4). The smell is weak. Taste is bitter, slimy To establish micro-diagnostic features of raw material preparations from the surface of the corolla, sepals and leaves of *V. songaricum* Shcrenk were prepared. The study under a microscope of the outer side of the corolla following diagnostic features are visible: numerous stellate hairs swollen at the apex of a multicellular stalk and diverging from it unicellular subulately rays with pointed tip (Figure 5.), as well as capitate hairs meet. When scrutinizing the inner side of the corolla a few stellate hairs and essential oil containers were visible. The coverig trichomes from the stamen filaments are unicellular, long, thin-walled and tubular, have a distinctly granular or striated surface with a sharp tip or sometimes with a club-shaped tip (Fig. 6). Under the microscope the numerous pollen grains, ovoid with a finely granular exine with 3 pores (Fig. 7) and the fibrous layer of the anther with thickened walls giving a characteristic star-shaped appearance (Fig. 8) observed. It was established that the epidermal cells are polygonal and isodiametric, also the underlying mesophyll consists of irregular parenchymatous cells, sometimes accompanied by spiral vessels (Fig. 9). While studying the inner surface of the sepals should be observed that the epidermis cells small, izodiametric, slightly elongated with nearly straight walls. Simple and stelate, single-celled, bicellular and capitate trichomes are visible. While viewing the outer surface of the sepals it can be seen that the epidermis densely covered

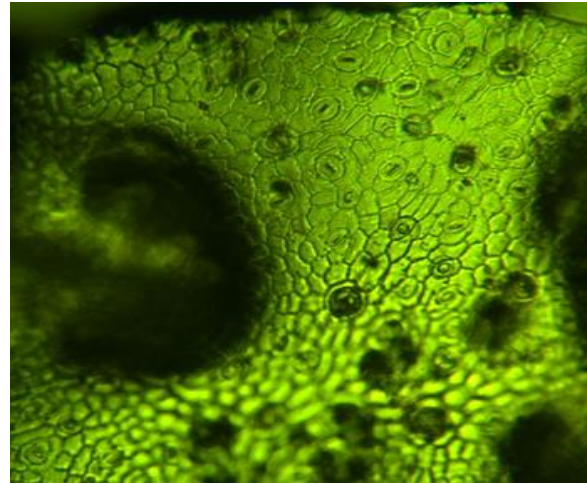
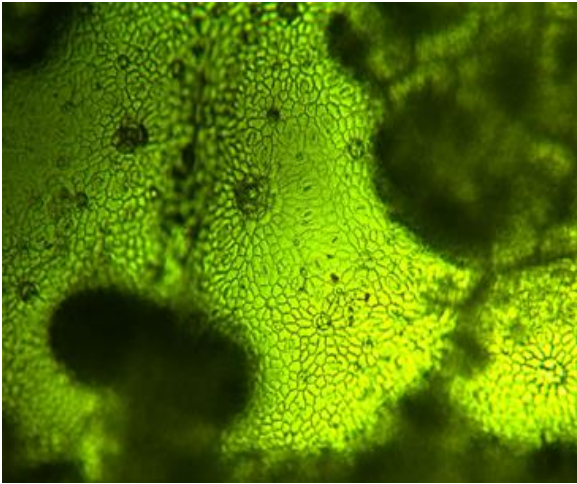


Figure 10: Epidermis of leaf

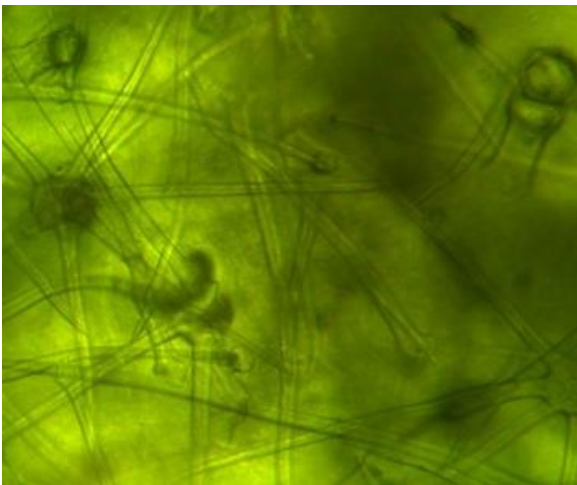


Figure 11: multicellular stellate and capitate hairs of leaf



Figure 12: Multicellular stellate trichomes of leaf

with multicellular stellate trichomes. When the study of the surface of leaves diacytic stomatal complex, multicellular stellate and capitate hairs (Figure 10,11,12,13) can be seen. In studying the edges of leaf little branching hairs and multicellular stellate hairs observed.

Thus, by authors of the study morphological and anatomical features, characteristic for the genus *Verbascum* were identified. Determination of morphological and anatomical features of *Verb* allowed to systematize the information needed to establish the authenticity of raw material - flowers and eliminate errors during the procurement of raw materials, and its analysis, significantly distinguished from the possible impurities. The results of this research can be used to develop a regulatory document on a new type of plant material, containing a rich complex of biologically active substances, which will expand the raw material base for the domestic herbal remedies. The studies established a set of diagnostic characteristics necessary to identify the raw material - the stem has a beam-type structure, open beams collateral; - Leaf of dorsoventral type: by location of stomata hypostomatal; - Poorly developed mechanical

tissue sclerenchyma; - Presented trichomes glandular hairs, glands of the radial type, opaque unicellular and multicellular hairs; - The type of stomatal apparatus - diacytic. The results obtained allow identifying the *Verbascum songaricum* raw material that is the basis for the development of "Microscopy" section for the project of normative documents.

REFERENCES

1. Heywood V.H. Flowering plants in the world. Oxford University Press, New York, 1993.
2. Celebi A., Karaveliogullari F.A., Acik L., Celep F. Taxonomic relationships in Turkish *Verbascum* L. Group A (Scrophulariaceae): evidence from SDS-PAGE of seed proteins and numerical taxonomic study. *Turk J Biochem* 2009, 34(4):234-241.
3. Avicenna. Canon of Medicine, Tashkent, 1956-1960.
4. Baytop T. Therapy with medical plants in Turkey (Past and Present), 2nd ed. Nobel Tip Kitabevleri Ltd, Istanbul, 1999.
5. Pharmacopea of the Republic of Kazakhstan, Vol.1, «Zhibek zholy», Almaty, 2008. – 592 p.