

**ЖАРАТЫЛЫСТАНУ ҒЫЛЫМДАРЫ / ЕСТЕСТВЕННЫЕ НАУКИ /
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**QUANTITATIVE DETERMINATION OF PHENOLIC COMPOUNDS IN
THE AERIAL PARTS OF *VERBASCUM ORIENTALE L.* GROWING IN THE
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*The article is devoted to a comparative study of the phenolic complex of the aerial parts of *Verbascum orientale L.* growing under the specific environmental conditions of East Kazakhstan. Qualitative chemical screening and differential spectrophotometry methods were used to determine the qualitative composition and quantitative content of the main groups of secondary metabolites. Flavonoids, phenolcarboxylic acids, and tannins were identified in the studied samples. The quantitative profile was characterized by the predominance of the flavonoid fraction (1.23) and phenolcarboxylic acids (1.18). The obtained data contribute to the chemosystematics of the genus *Verbascum* and substantiate the prospects for using the regional population of *V. orientale L.* as a source of antioxidant plant raw material.*

Keywords: *Verbascum orientale L.*; phytochemical profile, phenolic compounds, flavonoids, spectrophotometry, East Kazakhstan.

In modern pharmacognosy, the search for new sources of medicinal plant raw materials with high antioxidant potential remains a priority task. Of particular interest

are plants synthesizing a complex of phenolic compounds (PCs). Phenolic compounds not only determine the adaptive plasticity of plants under abiotic stress conditions (solar radiation, temperature fluctuations), but also exhibit pronounced biological activity ranging from anti-inflammatory to neuroprotective effects.

The genus *Verbascum* L. (family Scrophulariaceae) includes species rich in iridoids, saponins, and flavonoids. However, most studies have focused on European species such as *V. phlomoides* and *V. thapsus*. *Verbascum orientale* L. growing under the arid and sharply continental conditions of Eastern Kazakhstan remains insufficiently studied.

The aim of this work was the qualitative identification and quantitative determination of the main groups of phenolic compounds in the aerial parts of *V. orientale* L.

Materials and Methods

The object of the study was the aerial part of *Verbascum orientale* L. collected during the mass flowering stage in the East Kazakhstan region. The plant material was dried to an air-dry state and ground to a particle size of 1–3 mm.

Extraction of phenolic compounds was carried out using aqueous ethanol solutions under reflux heating followed by filtration and adjustment of the extract volume to a predetermined value.

Qualitative identification of phenolic compounds was performed using standard phytochemical reactions (reaction with FeCl_3 , reaction with AlCl_3 , and precipitation reactions for tannins).

The quantitative determination of flavonoids was carried out spectrophotometrically based on the formation of a complex with aluminum chloride at a wavelength of 430 nm, calculated in terms of quercetin.

The content of phenolcarboxylic acids was determined spectrophotometrically at a wavelength of 290 nm and expressed as chlorogenic acid equivalents.

The tannin content was determined by the permanganatometric method using indigo sulfonic acid as an indicator.

Statistical processing of the results included calculation of mean values and confidence intervals at a significance level of $P = 0.95$.

Results and Discussion

Primary phytochemical screening revealed the presence of a stable complex of phenolic metabolites in the aerial parts of *V. orientale* L. (Table 1).

Table 1 – Results of qualitative determination of biologically active compounds in the aerial parts of *Verbascum orientale* L.

Group of compounds	Reaction/characteristic used	Result
Flavonoids	Reaction with AlCl_3 solution	Appearance of yellow coloration
Tannins	Reaction with 10% lead acetate solution $\text{Pb}(\text{CH}_3\text{COO})_2$	Formation of a curdy precipitate

Phenolcarboxylic acids	Reaction with FeCl ₃	Appearance of pink-violet coloration
Coumarins	Lactone test	Formation of white precipitate

The results of quantitative determination of phenolic compounds are presented in Table 2.

Table 2 – Content of phenolic compounds in the aerial parts of *Verbascum orientale* L., %

Group of biologically active compounds	Content, %
Flavonoids	1.23%
Tannins	0.80%
Phenolcarboxylic acids	1.18%
Coumarins	0.65%

The distribution of biologically active compounds is shown in Figure 1.

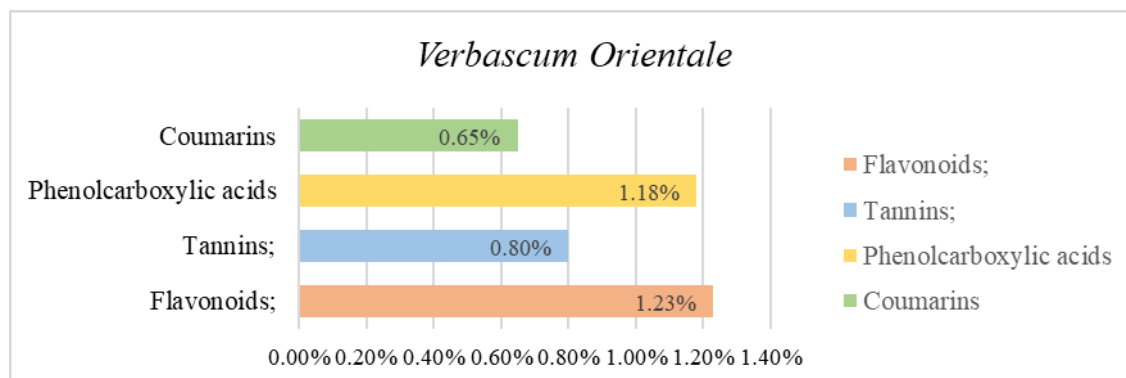


Figure 1 – Ratio of the main groups of biologically active compounds in the investigated plant material

The high content of flavonoids (1.23%) and phenolcarboxylic acids (1.18%) indicates pronounced antioxidant properties of the plant. According to the literature, plants of the *Scrophulariaceae* family are characterized by a close correlation between the accumulation of iridoids and phenolic acids. In the present study, the nearly equal ratio of flavonoids and acids (Figure 1) indicates a balanced metabolic pathway for polyphenol biosynthesis.

The obtained results indicate the formation of a pronounced phenolic profile in the investigated species, which is of interest for further studies of its biological activity.

Conclusions

As a result of the conducted study, a detailed phenolic profile of the East Kazakhstan population of *Verbascum orientale* L. was established for the first time.

The revealed high content of flavonoids and phenolcarboxylic acids allows this species to be classified as a promising source of plant raw material for the development of phytopreparations with antioxidant and anti-inflammatory activity. The obtained data may be used in the development of regulatory documentation for *V. orientale* L. medicinal plant raw material.

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ШЫҒЫС ҚАЗАҚСТАН АЙМАҒЫНДА ӨСЕТІН *VERBASCUM ORIENTALE* L. ӨСІМДІГІНІҢ ЖЕРҮСТІ БӨЛІГІНДЕГІ ФЕНОЛДЫ ҚОСЫЛЫСТАРДЫ САНДЫҚ АНЫҚТАУ

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Мақала Шығыс Қазақстанның ерекше экологиялық жағдайында өсетін шығыс аюқұлағының (Verbascum orientale L.) жерүсті бөлігіндегі фенолды қосылыстар кешенін салыстырмалы зерттеуге арналған. Сапалық химиялық скрининг және дифференциалды спектрофотометрия әдістері арқылы екіншілік метаболиттердің негізгі топтарының сапалық құрамы мен сандық

мөлшері анықталды. Зерттелген үлгілерде флавоноидтар, фенолкарбон қышқылдары және илік заттар идентификацияланды. Сандық профильде флавоноидты фракцияның (1,23) және фенолкарбон қышқылдарының (1,18) басым екендігі анықталды. Алынған нәтижелер *Verbascum* туысының хеможүйелілігі туралы мәліметтерді толықтырып, *V. orientale* L. аймақтық популяциясын антиоксиданттық қасиетке ие өсімдік шикізатының перспективасы көзі ретінде пайдалануға негіз болады.

Кілт сөздер: *Verbascum orientale* L.; фитохимиялық профиль, фенолды қосылыстар, флавоноидтар, спектрофотометрия, Шығыс Қазақстан.

КОЛИЧЕСТВЕННОЕ ОПРЕДЕЛЕНИЕ ФЕНОЛЬНЫХ СОЕДИНЕНИЙ В НАДЗЕМНОЙ ЧАСТИ *VERBASCUM ORIENTALE* L., ПРОИЗРАСТАЮЩЕГО В ВОСТОЧНО-КАЗАХСТАНСКОМ РЕГИОНЕ

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Статья посвящена сравнительному изучению фенольного комплекса надземной части коровяка восточного (*Verbascum orientale* L.), произрастающего в специфических экологических условиях Восточного Казахстана. Методами качественного химического скрининга и дифференциальной спектрофотометрии установлен качественный состав и количественное содержание основных групп вторичных метаболитов. В исследуемых образцах идентифицированы флавоноиды, фенолкарбоновые кислоты и дубильные вещества. Установлено, что количественный профиль характеризуется преобладанием флавоноидной фракции (1,23) и фенолкарбоновых кислот (1,18). Полученные данные вносят вклад в хемосистематику рода *Verbascum* и обосновывают перспективность использования региональной популяции *V. orientale* L. в качестве источника антиоксидантного растительного сырья.

Ключевые слова: *Verbascum orientale* L.; фитохимический профиль, фенольные соединения, флавоноиды, спектрофотометрия, Восточный Казахстан.