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MEDICINAL PROPERTIES OF THE CRATSAEGUS TURKESTANICA A.POJARK SPECIES

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ABSTRACT

Flavonoid compounds present in the fruits of Turkestan hawthorn (*Crataegus turkestani*ca A. Pojark), indigenous to the mountainous regions of Uzbekistan, were meticulously examined. Employing spectrophotometric analysis, the concentrations of rutin and hyperoside were quantified in both natural raw materials and pharmaceutical formulations. Elevated levels of flavonoids were observed in the pharmaceutical preparations. These findings substantiate the medicinal significance and distinctive composition of this species.

Keywords: *Crataegus turkestanica*, flavonoids, rutin, hyperoside, phytochemistry, medicinal plants, spectrophotometry, Uzbekistan**.**

ЛЕКАРСТВЕННЫЕ ОСОБЕННОСТИ CRATSAEGUS TURKESTANICA A.POJARK

АННОТАЦИЯ

Исследованы флавоноидные соединения плодов туркестанского боярышника (*Crataegus turkestanica* A. Pojark), произрастающего в горных районах Узбекистана. С применением спектрофотометрического метода было определено содержание рутина и гиперозида как в натуральном сырье, так и в фармацевтических препаратах. Установлено, что фармацевтические формы демонстрируют более высокие концентрации флавоноидов. Полученные данные характеризуют данный вид и подтверждают его лекарственную ценность.

Ключевые слова: *Crataegus turkestanica*, флавоноиды, рутин, гиперозид, фитохимия, лекарственные растения, спектрофотометрия, *Узбекистан*

INTRODUCTION

Members of the *Rosaceae* family have long been utilized as medicinal plants in both traditional and contemporary herbal medicine. In recent times, there has been a notable shift away from synthetic pharmaceuticals, with individuals increasingly gravitating towards natural and herbal remedies, commonly referred to as phytotherapy (the therapeutic use of plants).

One such plant is the hawthorn (*Crataegus* L.), a member of the Rosaceae family, which encompasses over 300 species globally, with 10 of these flourishing in Uzbekistan (V.P. Drobov, 1955). These species hold significant relevance in the realms of medicine and pharmacology, serving as vital medicinal plants [10].

In Europe, America, Israel, China, and Belarus, in addition to fruits and flowers, leaves and branches are also utilized in an official capacity.

LITERATURE REVIEW

The genus *Crataegus* L. (hawthorn) was introduced by A.B. Poyarkov in the Flora of Russia, encompassing a total of 40 species within this genus [9].

Crataegus is etymologically derived from the Greek terms “kratos,” signifying “strength,” and “ageyn,” meaning “to influence” [9].

A.B. Poyarkov [9] classified the genus *Crataegus* L. (hawthorn) into five distinct sections, predicated upon the characteristics of the fruits, their morphology, inflorescences, and foliar structures:

Section I. *Pinnatifidae* – characterized by fruits comprising 3 to 5 seeds, exhibiting smooth sides, substantial flesh that is firm, and a hairy texture.

Section II. *Sagnineae* – defined by fruits containing 3 to 5 seeds that are laterally compressed and pitted.

Section III. *Pentagynae* – distinguished by fruits with black or reddish flesh, harboring 3 to 5 triangular seeds that are laterally compressed and adorned with longitudinal stripes on the dorsal side.

Section IV. *Azarali* – notable for inflorescences covered in felt-like hairs and exhibiting a short stature. The fruits are reddish-yellow, containing 2 to 5 seeds, with the lateral surfaces of the seeds either smooth or white. The petiole is significantly shorter, measuring 3 to 8 times less than the length of the leaf blade.

Section V. *Oxyacantha* – characterized by fruits ranging in color from light red to deep black, with 1 to 3 seeds. The seeds are concave on one side and feature longitudinal stripes on the reverse. The flesh of the fruit is yellow, and the inflorescence is sparse. The leaves are pinnately divided, with the petiole being 1.5 to 2 times shorter than that of the leaf blade.

Crataegus turkestanica A.Pojark is predominantly found in the Tashkent, Fergana, Samarkand, Kashkadarya, and Surkhandarya regions of Uzbekistan. This species thrives on the rugged slopes of mountainous terrains.

The medicinal properties of *Crataegus* L. are predominantly ascribed to the intricate array of flavonoids, procyanidins, triterpene saponins, organic acids, and various other biologically active compounds it encompasses [6, 7].

V.A. Sagaradze [10] acquired novel insights into the flavonoid composition (including vitexin, rutin, hyperoside, and quercetin) present in 15 species and one hybrid of hawthorn flourishing in Russia; he also devised innovative methodologies for the purification of raw materials, specifically "hawthorn flowers and leaves," from organic contaminants. Furthermore, in 2019, T.V. Morozova undertook an investigation into the pharmacognostic attributes of select species within the Hawthorngenus [7].

N.K. Jalalova (2022) investigated the quality of the novel medicinal plant raw material derived from the Almaty hawthorn (*Crataegus almatensis*) proliferating in the Kyrgyz Republic [5]. V.A. Gusakova conducted an in-depth examination of the phytochemical attributes of the raw material from the soft hawthorn (*Crataegus submollis* Sarg.), which has been introduced in the Russian Federation. Her findings revealed that the raw material encompasses several primary groups of compounds, including flavonoids, coumarins, tannins, saponins, ascorbic acid, amino acids, micro- and macroelements, polysaccharides, and carotenoids [2].

N.A. Volkova investigates the species C. sanguinea, C. monogyna, and C. submollis of the genus *Crataegus* L. as a promising source for the extraction of biologically active compounds [1]. K.I. Enikeeva (2023) conducted an examination of the hawthorn *Crataegus rivularis* Nutt.; A.A. Pavlova (2024) engaged in a pharmacognostic analysis and evaluation of the biological activity of Pennsylvania hawthorn (*Crataegus pensylvanica* Ashe) [4, 8].

Materials and methods: The fruits of Turkestan hawthorn (*Crataegus turkestanica* A. Pojark), rutin standard, and a spectrophotometer were utilized.

RESEARCH METHODS AND RESULTS

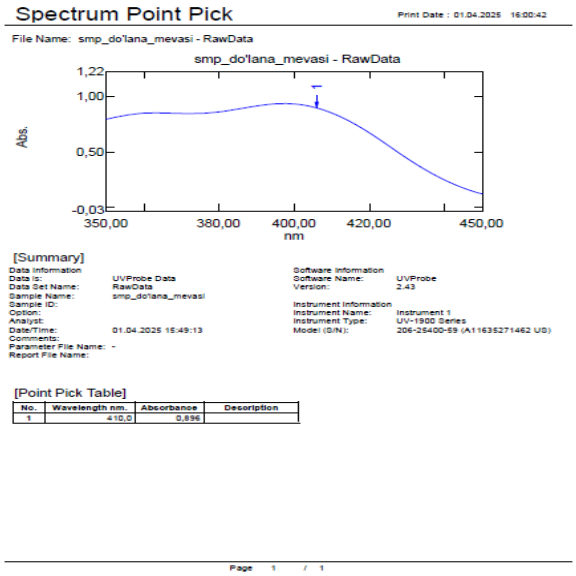
An alcoholic solution of aluminum chloride at a concentration of 2% is prepared by dissolving 2 grams of aluminum chloride in 50 milliliters of 70% alcohol solvent within a 100 milliliter volumetric flask. The volume of the solution is then adjusted to the calibration mark with the same solvent and thoroughly mixed. It is imperative that the shelf life of this solution does not exceed three months, and it should be stored in a cool, dark environment.

Approximately 5.0 g (measured with precision) of the sample, finely ground to pass through 1 mm mesh, is introduced into a 250 ml volumetric flask. To this, 50 ml

of 96% ethanol is added, and the mixture is subjected to heating for 60 minutes in a boiling water bath. Following this, the flask is allowed to cool to ambient temperature before being filtered through a paper filter into a 100 ml volumetric flask. An additional 30 ml of 96 % ethanol is incorporated into the flask, and the solution is again heated in a boiling water bath for 60 minutes. After cooling, the solution is filtered once more and transferred back to the original flask. Subsequently, another 20 ml of 96 % ethanol is added, subjected to heating in a boiling water bath for an additional 60 minutes, after which the solution is filtered again and returned to the same flask. The volume of the solution in the flask is adjusted to the calibration mark with 96% ethanol, resulting in the preparation of test solution A (Table 1,2).

Table 1

Bioactive substances in hawthorn



0,896	100	25	100	1	%
380	10	100	4,2	5,0123	0,12

Содержание суммы флавоноидов в пересчете на гиперозид в абсолютно сухом сырье в процентах (X) вычисляют по формуле:

$$X = \frac{A \cdot 100 \cdot 25 \cdot 100}{A_{1см}^{1\%} \cdot a \cdot 10 \cdot (100 - W)} = \frac{A \cdot 25000}{A_{1см}^{1\%} \cdot a \cdot (100 - W)},$$

где:

A - оптическая плотность раствора Б испытуемого раствора;

$A_{1см}^{1\%}$ - удельный показатель поглощения комплекса гиперозида с алюминия хлоридом при длине волны 410 нм, равный 380;

a - навеска сырья, г;

W - влажность сырья, %.

10 ml of test solution A is meticulously transferred to a 25 ml volumetric flask, followed by the addition of 6 ml of a 2 % alcoholic solution of aluminum chloride. The volume is then adjusted to the calibrated mark with 96 % alcohol and thoroughly mixed, resulting in test solution B. The optical density of test solution B is subsequently measured using a spectrophotometer at a wavelength of 410 nm, employing a 10 mm thick cuvette. For the reference solution, 10 ml of test solution A and 0.1 ml of concentrated acetic acid are combined in a 25 ml volumetric flask, which is then filled to the mark with 96% alcohol. The normative threshold is established at no less than 0.04 %.

Table 2
Bioactive substances in hawthorn

Crataegus turkestanika A.Pojark			
In natural form		In pharmacies	
Geperozid, %	Rutin, %	Geperozid, %	Rutin, %
1.67	0.12	3.13	0.23

CONCLUSION AND SUGGESTIONS

The findings of the study revealed notable disparities in the concentrations of the principal flavonoid compounds – rutin and hyperoside – within the unprocessed raw material derived from the fruit of the *Crataegus* L. (hawthorn) plant, as compared to its formulation prepared under pharmaceutical conditions. Specifically, the concentration of rutin in the naturally cultivated fruit of *Crataegus turkestanica* A. Pojark was determined to be 0.12 %, while that of hyperoside was quantified at 1.67 %.

In the realm of pharmaceutical preparations, the observed indicators were 0.23 % and 3.13 %, respectively. The results obtained indicate that the flavonoid content in pharmaceutical formulations surpasses that found in natural raw materials. This phenomenon can be attributed to the fact that the preparations, meticulously crafted under pharmaceutical conditions from the fruits of the hawthorn plant – a composite of both natural and cultivated species within the *Crataegus* genus (C.sanguinea Pall. – red hawthorn, C.laevigata (Poir.) DC. – flat hawthorn; C.oxyacantha Pojark – prickly hawthorn; C.korolkovii L. – Korolkov hawthorn; C.altaica (Lond.) Lange – Altai hawthorn; C.chlorocarpa Lenne et C.koch – yellow solanum; C.dahurica Koehne ex Schneid. – Daurian hawthorn) – demonstrated a markedly elevated indicator.

In conclusion, it can be asserted that the rutin content in the raw material of natural Turkestan hawthorn is 0.12 %, while hyperoside is present at 1.67 %. These figures are characteristic of the species *Crataegus turkestanica* A. Pojark, which is indigenous to the mountainous regions of Uzbekistan. Consequently, it is advisable to partake in the consumption of the fruits of naturally cultivated Turkestan hawthorn.

REFERENCES:

1. Волкова Н.А. Фармакогностическое исследование сырья представителей – источника биологически активных соединений: автореф. дис. … канд. фарм. наук. – Самара, 2024. – 23 с.

2. Гусакова В.А. Фитохимическое изучение и перспективы использования боярышника мягковатого (*Crataegus submollis* Sarg.): автореф. дис. … канд. фарм. наук. – Пермь, 2022. – 19 с.
3. Дробов В.П. Флора Узбекистана. – Ташкент: АН УзССР, 1955. – 350 с.
4. Еникеева К.И. Фармакогностическое изучение и биологическая активность боярышника приречного (*Crataegus rivularis* Nutt.): автореф. дис. … канд. фарм. наук. – Пермь, 2023. – 23 с.
5. Жалолова Н.К. Фармакогностическое изучение боярышника алма-атинского (*Crataegus almaatensis* Pojark.): автореф. дис. … канд. фарм. наук. – Пермь, 2022. – 24 с.
6. Куркин А.В. Экспериментально-теоретическое обоснование подходов к стандартизации сырья и препаратов фармакопейных растений, содержащих флавоноиды: автореф. дис. … канд. фарм. наук. – Самара, 2013. – 49 с.
7. Морозова Т.В. Фармакогностическое исследование некоторых видов рода боярышник (*Crataegus* L.): автореф. дис. … канд. фарм. наук. – Самара, 2019. – 23 с.
8. Павлова А.А. Фармакогностическое исследование боярышника пенсильванского (*Crataegus pensylvanica* Ashe): автореф. дис. … канд. фарм. наук. – Самара, 2024. – 23 с.
9. Поярков А.И. *Crataegus oxyacantha* L. // Флора СССР. – М., Л.: Изд-во АН СССР, 1939. – Т. 9. – С. 422–426.
10.Сагарадзе В.А. Фармакогностическое исследование и стандартизация перспективного лекарственного растительного сырья «Цветки с листьями» видов рода *Crataegus* L. флоры Российской Федерации: автореф. дис. … канд. фарм. наук. – Москва, 2019. – 25 с.