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# Comparative investigation of *Rheum tataricum* and *Rheum palmatum*

**Abstract:** Medicinal plants have played a crucial role in both traditional and modern medicine for centuries. Among these, *Rheum tataricum* and *Rheum palmatum* have attracted significant attention due to their diverse pharmacological properties and rich chemical compositions. Despite their widespread use, detailed comparative studies of these species remain limited. This study aims to provide a comprehensive evaluation of their morphological characteristics, chemical profiles, and pharmacological effects to enhance their application in medicine and drug development. The study involved the identification of liposoluble constituents in *R. tataricum* and *R. palmatum* using Gas Chromatography-Mass Spectrometry (GC-MS). The chemical compositions of both species were investigated, and their bioactive compounds were quantified. The pharmacological significance of key compounds such as oleic acid, hexadecanoic acid, octadecadienoic acid, chrysophanol, and apocynin was evaluated based on existing literature.

GC-MS analysis revealed distinct differences in the chemical compositions of *R. tataricum* and *R. palmatum*. The Chinese species, *R. palmatum*, contained twenty-four compounds, with oleic acid (53.9±0.09%) as a predominant constituent. In contrast, *R. tataricum* from Kazakhstan contained eighteen compounds, with a notably higher content of chrysophanol (35.1±0.05%). Hexadecanoic acid (18.9%) was found to be a major component in both species, demonstrating moderate antibacterial activity. Other bioactive compounds such as octadecadienoic acid, 9,10-anthracenedione, apocynin, and orcinol were detected, indicating their potential therapeutic applications.

This comparative study provides valuable insight into the chemical compositions and pharmacological relevance of *R. tataricum* and *R. palmatum*. The significant variation in bioactive compound concentrations suggests distinct therapeutic potentials. These findings support the rational use of these medicinal plants in pharmaceutical applications and highlight their relevance in both drug discovery and traditional medicine practices.
**Key words:** Medicinal plants, *Rheum tataricum*, *Rheum palmatum*, phytochemical content, GC-MS.

## Introduction

Medicinal plants have long held a pivotal position in both traditional and modern medicine. For centuries, they have been the cornerstone of treating a wide array of diseases and health conditions, and their significance in the medical field is indisputable [1]. Among the vast number of medicinal plants, *Rheum tataricum* and *Rheum palmatum* have emerged as two highly valuable species that have attracted global research interest.

*Rheum tataricum*, commonly referred to as Tatarian rhubarb, belongs to the genus *Rheum* in the family Polygonaceae. It is mainly distributed in certain regions of Central Asia and Eastern Europe, thriving in mountainous areas with specific climate and soil conditions [2]. Its root, which is thick and fleshy with a brownish-black outer layer, has been used in traditional medicine for its laxative and anti-inflammatory properties [3]. Traditional healers have prepared it in various forms such as decoctions, powders, and tinctures to treat digestive disorders such as constipation and indigestion, as well as to relieve joint pain, inflammation, and treat various skin diseases [4]. In terms of its chemical composition, *Rheum tataricum* is rich in anthraquinones, such as emodin, chrysophanol, and aloe-emodin, which are thought to contribute to its laxative and anti-inflammatory effects. It also contains flavonoids, tannins, and polysaccharides, which may play roles in its antioxidant and immunomodulatory activities [5].

*Rheum palmatum*, also known as Chinese rhubarb, is another member of the genus *Rheum*. It is native to China and widely distributed in the mountainous regions of western and central China [6]. Growing in high-altitude areas with a cool climate and well-drained soil, it has a large and robust root with a dark brown or blackish outer bark. In traditional Chinese medicine, it has a long and rich history of use. Considered one of the most important medicinal plants, it is used for a broad range of therapeutic purposes. The root and rhizome are commonly used, and it is renowned for its strong purgative effect, often used to treat constipation and to clear internal heat [7]. Additionally, it exhibits antibacterial, anti-inflammatory, and antioxidant properties and has been applied in the treatment of liver diseases, infectious diseases, and certain types of cancers [8]. *Rheum palmatum* is also abundant in anthraquinones, but the content and proportion of different anthraquinone derivatives may vary compared to *Rheum tataricum*. Besides anthraquinones, it contains other bioactive components such as stilbenes, phenolic acids, and volatile oils. These compounds contribute to its diverse pharmacological activities, including antibacterial, anti-inflammatory, and antioxidant effects [9].

With the increasing interest in natural products for medicinal purposes, a comprehensive understanding of these two plants becomes crucial for further exploration and utilization. Their rich chemical compositions and diverse biological activities make them promising sources for developing of new drugs and therapies [10].

*Research Objectives.* The primary aim of this study is to conduct a detailed comparison between *Rheum tataricum* and *Rheum palmatum*. This comparison will cover their morphological characteristics, chemical compositions, pharmacological effects, and clinical applications. By systematically analyzing the differences and similarities between these two species, we intend to provide a scientific basis for their rational utilization and development. Such a comparison will not only facilitate better identification and classification of these plants but also contribute to a more in-depth understanding of their potential in the pharmaceutical and medical fields.

*Research Significance.* From a theoretical perspective, this comparative study will greatly enrich the knowledge base of medicinal plant science. It will deepen our understanding of the relationships between different species within the *Rheum* genus and contribute to the development of plant taxonomy and pharmacognosy [11]. By identifying the unique features and properties of *Rheum tataricum* and *Rheum palmatum*, we can gain valuable insights into the evolutionary adaptations and biological functions of these plants.

In practical terms, the results of this study will have significant implications for drug development and clinical application. Understanding the differences in chemical compositions and pharmacological effects between the two plants can assist researchers in selecting the most suitable plant material for specific drug targets. This can lead to the development of more effective and targeted drugs, shortening the cost and time of drug discovery. Moreover, for traditional medicine practitioners, this research can provide scientific evidence to support the rational use of these plants in clinical practice, thereby improving the safety and efficacy of traditional therapies [12].

## Materials and methods

*Plant raw material. Rheum tataricum* was collected during the plant expedition around the Almaty region in May 2024. Specifying, 12 kilometers away from Kokbek village with the geographical location coordinates 43.400270 and 78.806415 referring to latitude and longtitude, accordingly. *Rheum palmatum* were acquired from China, as it is endemic to Chinese lands. Both species were slightly washed with pure water, dried in sunless place, crushed into small pieces by After being thoroughly dried in the shade, raw materials were crushed into small pieces using a herb grinder machine 2500Y (Yongkang Boou Hardware Products Co., Ltd., China) and stored at room temperature.

*Quantitative and qualitative analysis*

The moisture content and ash of raw herbal plant materials were determined in accordance with the standards of the state Pharmacopeia [13, 14].

Analytical balances, a SNOL 67/350 dryer (AB UMEGA, Lithuania), a muffle furnace, and a desiccator can be used to quantitatively assess raw materials, including moisture content and ash percentage. Extractive compounds must be identified using a reflux condenser, drier, and balances. Flavonoids, free organic acids, alkaloids, saponins, tannins, and coumarins are common bioactive classes that can be qualitatively analyzed using equipment such as a flask, reflux condenser, and analytical balances. A UV-5500 UV-VIS spectrophotometer (Shanghai Metash Instruments Co., Ltd, China) was used at various wavelengths to determine the content of flavonoids, saponins, and coumarins. The burette is used to titrate and measure the concentration of free organic acids and alkaloids. Polysaccharides are identified after drying the extract to a uniform volume.

*Determination of organic compounds by gas chromatography-mass spectrometry*

The analysis of the samples was performed using gas chromatography coupled with mass spectrometric detection (GC-MS) utilizing an Agilent 7890A gas chromatograph and 5975C mass spectrometric detector. The exact conditions including split ratio, velocity and temperature change are shown in the Table 1.

*Detection and Data Processing:* Detection was conducted in SCAN mode, covering the m/z range of 34–850. Agilent MSD ChemStation software (version 1701EA) was used for system control, data recording, and result processing. Data analysis included determination of retention times, peak areas, and spectral data interpretation using the mass spectrometric detector.

*Spectral Libraries:* The identification of mass spectra was performed using the Wiley 7th Edition and NIST'02 libraries, containing over 550,000 spectra.

**Table 1** – Condition of analysis for organic compounds identification by GC-MS

| ***Analysis conditions*** | |
|---|---|
| Sample Volume | 0.5 µL |
| Sample Insertion Temperature | 280 °C |
| Split Ratio | 10:1 |
| Solvent Delay | 10 minutes |
| Chromatographic Column | DB-WAXetr capillary column |
| Carrier Gas | Helium |
| Constant velocity | 1 mL/min |
| ***Temperature Program*** | |
| Initial temperature | 40°C |
| Heating rate | 5°C/min |
| Final temperature | 260°C (held for 5 minutes) |
| Total analysis time | 49 minutes |

## Results and discussion

*Quantitative and qualitative analysis of bioactive constituent classes*

As a fundamental step, the cleaned and dried plant material was checked for authenticity that implies the content of moisture, ash and substances extracted by different concentration of water-ethanol concentrations. The classes of biologically active compounds identified include flavonoids, polysaccharides, free organic acids, coumarins, tannins. The results of identification are shown in Table 2.

**Table 2** – The quantitative-qualitative analysis of *R. tataricum* and *R. palmatum*

| **Authenticity** | *R. tataricum*, % | *R. palmatum*, % |
|---|---|---|
| Moisture | 4.30 | 3.30 |
| Ash content | 8.50 | 8.32 |
| Extractive substances (50% EtOH) | 20.9 | 21.3 |
| Extractive substances (70% EtOH) | 38.5 | 40.1 |
| Extractive substances (96% EtOH) | 36.0 | 32.2 |
| **Content of BAC, %** | | |
| Free organic acids | 0.88 | 0.47 |
| Flavonoids | 0.06 | 0.04 |
| Polysaccharides | 6.36 | 2.07 |
| Tannins | 7.40 | 3.67 |
| Coumarins | 3.64 | 2.40 |

The analysis of *R. tataricum* and *R. palmatum* revealed differences in moisture content, ash content, and extractive substances obtained using various ethanol concentrations. These findings provide insights into the composition of these species and their potential applications in different industries. Moisture content plays a critical role in the stability and storage of plant materials. *R. tataricum* exhibited a higher moisture content (4.30%) compared to *R. palmatum* (3.30%). This difference may indicate varying degrees of hygroscopicity and suggests that *R. tataricum* might require more stringent drying conditions to prevent microbial growth and degradation. The ash content, which represents the total mineral composition of the plant material, was similar between the two species, with *R. tataricum* containing 8.50% and *R. palmatum* containing 8.32%. These values suggest that both species have comparable inorganic constituents, which may influence their potential use in pharmaceutical or food applications.

The yield of extractive substances varied depending on the ethanol concentration used. When extracted with 50% ethanol, *R. palmatum* yielded a slightly higher extractive content (21.3%) compared to *R. tataricum* (20.9%). This trend continued with 70% ethanol, where *R. palmatum* (40.1%) exhibited a greater extractive yield than *R. tataricum* (38.5%). However, at 96% ethanol, *R. tataricum* (36.0%) had a higher yield than *R. palmatum* (32.2%). These variations indicate differences in the solubility of phytochemicals present in the plants, suggesting that *R. palmatum* may contain more polar compounds while *R. tataricum* retains higher levels of less polar compounds. In general, 70% ethanol-water solvent is more effective and appropriate than 50% and 96% ethanol.

The observed differences in extractive yields imply that different solvent concentrations may be required to optimize the extraction of bioactive compounds from these species. The higher yield in 70% ethanol extraction suggests the presence of a significant amount of both polar and non-polar compounds in both plants. Additionally, the higher extractive yield in 96% ethanol for *R. tataricum* indicates potential for extracting lipophilic components, which could be relevant for pharmaceutical and cosmetic applications. Overall, these findings provide valuable insights into the chemical composition of *R. tataricum* and *R. palmatum*, contributing to the understanding of their potential applications in herbal medicine, nutraceuticals, and related fields.

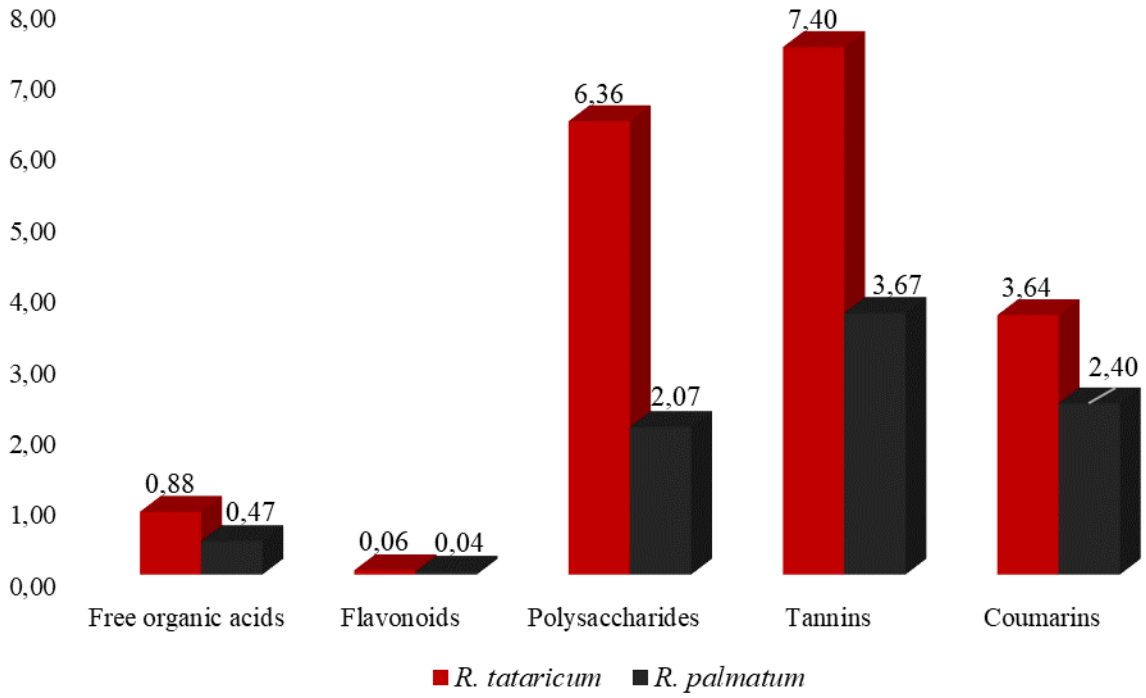


**Figure 1** – Comparative content of bioactive compounds in *R. tataricum* and *R. palmatum*

The comparative analysis of biologically active compounds (BACs) in *Rheum tataricum* and *Rheum palmatum* revealed significant differences in their composition. The content of free organic acids in *R. tataricum* (0.88%) was almost twice as high as that in *R. palmatum* (0.47%). This suggests that *R. tataricum* may exhibit stronger acidity, potentially influencing its pharmacological properties, such as antimicrobial and digestive activities. The higher level of free organic acids in *R. tataricum* could contribute to its greater solubility and enhanced bioavailability of active components.

Flavonoid content was slightly higher in *R. tataricum* (0.06%) compared to *R. palmatum* (0.04%). Flavonoids are known for their antioxidant, anti-inflammatory, and cardioprotective effects. The minor difference in flavonoid content indicates that both species may have similar antioxidant potential, though *R. tataricum* may have a slight advantage in this regard.

A notable difference was observed in the polysaccharide content, with *R. tataricum* containing a significantly higher amount (6.36%) compared to *R. palmatum* (2.07%). Polysaccharides are essential bioactive compounds known for their immunomodulatory, prebiotic, and anti-inflammatory properties. The substantial difference suggests that *R. tataricum* may offer superior immune-boosting benefits and better support for gut health compared to *R. palmatum*. Tannin levels in *R. tataricum* (7.40%) were considerably higher than in *R. palmatum* (3.67%). Tannins are known for their astringent properties and their ability to enhance wound healing, provide antimicrobial effects, and regulate digestion. The higher tannin content in *Kazakhstani Rheum* suggests it may have stronger therapeutic potential in gastrointestinal health and antimicrobial applications. The coumarin content in *R. tataricum* (3.64%) was also higher than in *R. palmatum* (2.40%). Coumarins possess anticoagulant, anti-inflammatory, and antimicrobial properties. The increased presence of coumarins in *R. tataricum* may indicate greater potential for cardiovascular protection and anti-inflammatory applications compared to *R. palmatum*.

Overall, the results indicate that *R. tataricum* consistently contains higher levels of biologically active compounds compared to *R. palmatum*. This suggests that *R. tataricum* may have a broader pharmacological spectrum and potentially stronger therapeutic effects. The higher concentrations of polysaccharides, tannins, and coumarins in *R. tataricum* make it a promising candidate for applications in immune support, gastrointestinal health, and cardiovascular protection. However, further studies on bioavailability, pharmacokinetics, and clinical efficacy are necessary to validate these findings and determine their practical applications.

*Gas chromatography combined with mass spectrometry assay*

Liposoluble constituents presenting in *R. tataricum* and *R. palmatum* species were identified through the analysis of petroleum ether extracts applying GC-MS. Chinese species, *R. palmatum* consist of twenty-four compounds in general, results are presented in Table 3 together with chromatogram represented in Figure 2. The results of *Rheum tataricum* from Kazakhstan shown in Table 4 and Figure 4, where 18 compounds were identified in general. The content of two species differentiates slightly. All data are expressed as the mean ± standard deviation of three replicates.

**Table 3** – Results of chromatographic analysis of the petroleum ether extract of *R. palmatum*

| № | Retention time, min | Constituents | Probability of identification, % | Content, % |
|---|---|---|---|---|
| 1 | 12.15 | 1-Butoxy-1-isobutoxy-butane | 89 | 0.9±0.01 |
| 2 | 17.80 | Cyclohexanol, 5-methyl-2-(1-methylethyl)- | 92 | 0.8±0.01 |
| 3 | 20.50 | Benzenepropanoic acid, α-methyl- | 68 | 0.1±0.01 |
| 4 | 23.13 | Benzyl nitrile | 90 | 0.4±0.01 |
| 5 | 27.70 | Eugenol | 89 | 0.3±0.01 |
| 6 | 30.58 | Phenol, 2,4-bis(1,1-dimethylethyl)- | 89 | 0.2±0.01 |
| 7 | 34.21 | Ethyl Oleate | 84 | 1.0±0.01 |
| 8 | 34.78 | 9,12-Octadecadienoic acid, ethyl ester | 85 | 1.7±0.01 |
| 9 | 34.95 | Hydrocinnamic acid | 90 | 1.8±0.01 |

*Continuation of the table*

| № | Retention time, min | Constituents | Probability of identification, % | Content, % |
|---|---|---|---|---|
| 10 | 35.64 | Ethyl 9,12,15-octadecatrienoate | 76 | 0.3±0.01 |
| 11 | 36.61 | Dibutyl phthalate | 85 | 0.2±0.01 |
| 12 | 36.69 | Tetradecanoic acid | 71 | 0.2±0.01 |
| 13 | 37.61 | 2-Butanone, 4-(4-hydroxy-3-methoxyphenyl)- | 83 | 0.3±0.01 |
| 14 | 37.75 | Benzenebutanoic acid, 2,5-dimethyl- | 76 | 0.3±0.01 |
| 15 | 38.25 | Pentadecanoic acid | 77 | 0.3±0.01 |
| 16 | 38.51 | 2-Propenoic acid, 3-phenyl- | 92 | 4.2±0.03 |
| 17 | 39.32 | Hexadecanoic acid, 1-(hydroxymethyl)-1,2-ethanediyl ester | 66 | 0.5±0.02 |
| 18 | 39.77 | Hexadecanoic acid | 94 | 18.9±0.2 |
| 19 | 40.13 | 9-Hexadecenoic acid | 80 | 1.7±0.02 |
| 20 | 40.40 | 2-Butanone, 4-(4-hydroxyphenyl)- | 81 | 0.7±0.01 |
| 21 | 42.63 | Octadecanoic acid | 80 | 1.4±0.01 |
| 22 | 43.53 | Oleic Acid | 94 | 53.9±0.09 |
| 23 | 44.33 | 9,12,15-Octadecatrienoic acid, (Z,Z,Z)- | 92 | 8.0±0.01 |
| 24 | 51.04 | 9,10-Anthracenedione, 1,8-dihydroxy-3-methyl- | 70 | 1.8±0.02 |

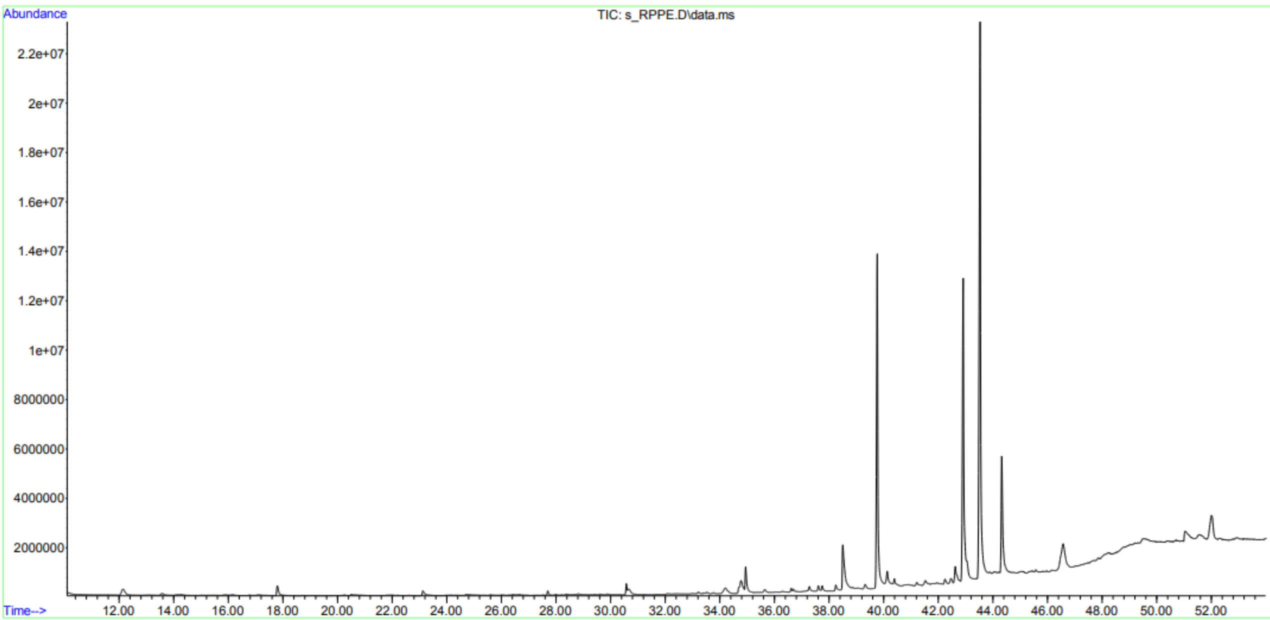


**Figure 2** – Chromatogram of *Rheum palmatum* L. petroleum ether extract

According to GC-MS analysis of Chinese species of *Rheum*, the higher content of oleic acid (53.9±0.09 %) at 43.53 minutes can be observed. Oleic acid, as shown in Figure 3A, is the predominant monounsaturated fatty acid in the human bloodstream [15]. Within the brain, it serves as a crucial component of membrane phospholipids and is abundantly present in myelin [16]. A notable reduction in oleic acid levels has been reported in the brains of individuals suffering from major depressive disorder and Alzheimer's disease [17]. Like all free fatty acids, oleic acid primarily functions as an energy source and a structural element of cell membranes. Consequently, oleic acid is now acknowledged as a multifunctional nutraceutical and a potent biomolecule. One of its most distinctive properties is its antioxidant capability, as it can directly influence both the synthesis and activity of antioxidant enzymes [18].

Furthermore, Hexadecanoic acid, also known as palmitic acid, with concentration of 18.9±0.2 % identified at 39.77 minutes can be assumed as one of the major components in *Rheum* species. Hexadecanoic acid (Figure 3B) exhibited moderate antibacterial activity against *S. aureus, B. subtilis, E. coli*, and *K. pneumoniae* at a maximum concentration of 50 µg/ml. For example, Ganesan et al. reported the biological activity of hexadecanoic acid derived from *Ipomoea eriocarpa* and suggests its potential application as a natural antioxidant and antibacterial agent in the pharmaceutical industry [19].

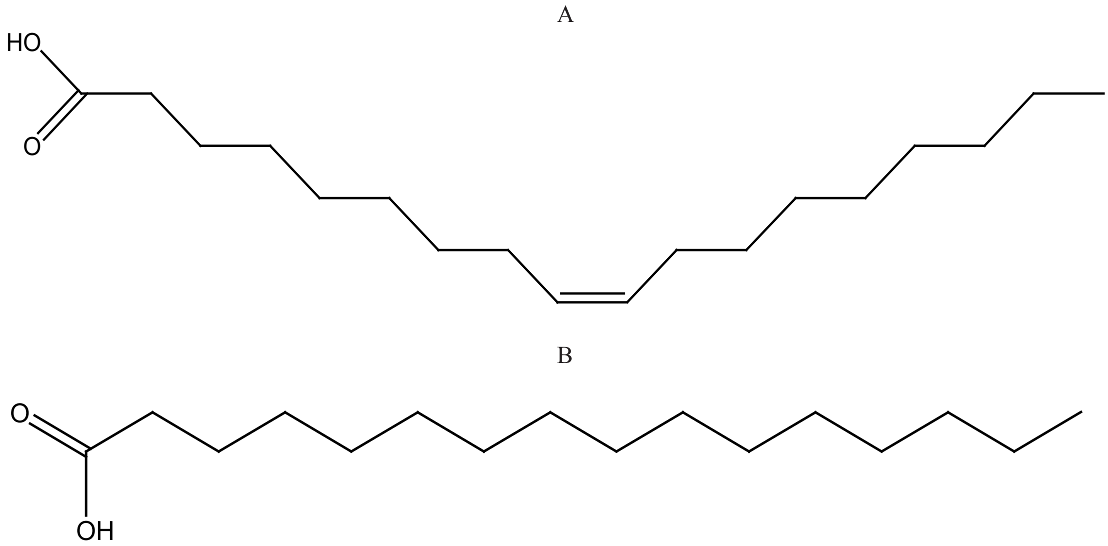


**Figure 3** – Structures of oleic acid **(A)** and Hexadecanoic acid **(B)**

Other constituents as 9,12,15-Octadecatrienoic acid, (Z,Z,Z)- (8.0 %) and 2-Propenoic acid, 3-phenyl- (4.2 %) are also essential biochemical components in this medicinal plant. Octadecadienoic acid (ODA) is an essential fatty acid, meaning that the human body is unable to synthesize it and must obtain it through dietary intake [20]. ODA serves as a precursor to two crucial long-chain omega-3 fatty acids, eicosapentaenoic acid and docosahexaenoic acid, both of which play a significant role in inhibiting prostate tumor growth, supporting brain development, promoting cardiovascular health, regulating metabolic-inflammatory responses, and influencing conditions such as obesity, diabetes, and mental disorders [21].

**Table 4** – Results of chromatographic analysis of the petroleum ether extract of *R. tataricum*

| № | Retention time, min | Constituents | Probability of identification, % | Content, % |
|---|---|---|---|---|
| 1 | 11.05 | Heneicosane | 71 | 1.9±0.02 |
| 2 | 11.43 | Cyclohexanol, 5-methyl-2-(1-methylethyl)-, acetate, (1α,2α,5β)- | 81 | 1.4±0.01 |
| 3 | 12.95 | Cyclohexanol, 1-methyl-4-(1-methylethyl)- | 95 | 7.9±0.02 |
| 4 | 15.62 | Hentriacontane | 70 | 3.0±0.01 |
| 5 | 18.23 | Benzyl nitrile | 72 | 1.4±0.01 |
| 6 | 25.57 | Phenol, 2,4-bis(1,1-dimethylethyl)- | 92 | 6.2±0.01 |

*Continuation of the table*

| № | Retention time, min | Constituents | Probability of identification, % | Content, % |
|---|---|---|---|---|
| 7 | 28.13 | 1H-2-Benzopyran-1-one, 3,4-dihydro-8-hydroxy-3-methyl- | 91 | 17.9±0.04 |
| 8 | 29.17 | Octadecanoic acid, ethyl ester | 72 | 2.6±0.02 |
| 9 | 29.30 | Phthalic acid, isobutyl 4-octyl ester | 68 | 0.9±0.02 |
| 10 | 29.68 | Phthalic acid, isobutyl 4-octyl ester | 65 | 7.2±0.03 |
| 11 | 30.48 | Apocynin | 63 | 3.1±0.01 |
| 12 | 31.61 | Dibutyl phthalate | 90 | 1.3±0.02 |
| 13 | 32.21 | 7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione | 66 | 0.5±0.01 |
| 14 | 34.76 | Hexadecanoic acid | 75 | 1.9±0.02 |
| 15 | 35.22 | Benzoic acid, 4-hydroxy-3,5-dimethoxy-, hydrazide | 68 | 0.6±0.01 |
| 16 | 37.69 | Orcinol | 75 | 2.1±0.01 |
| 17 | 41.17 | 2',4'-Dihydroxy-3'-methylacetophenone | 88 | 5.0±0.02 |
| 18 | 46.00 | 9,10-Anthracenedione, 1,8-dihydroxy-3-methyl- | 86 | 35.1±0.05 |

Compared to *R. palmatum*, the content of 9,10-Anthracenedione, 1,8-dihydroxy-3-methyl- (chrysophanol) in *R. tataricum* (35.1±0.05%) is several times higher. It is the major anthraquinone found in *Rheum* species. Chrysophanol (Figure 5A), a naturally derived anthraquinone compound, has shown great promise in cancer therapy due to its wide range of biological activities [22].

Moreover, there is quantitatively 17.9+0.04% of 1H-2-Benzopyran-1-one, 3,4-dihydro-8-hydroxy-3-methyl- (Figure 5B), which exhibits cytotoxic activity and accelerates the growth of SIV branch [23]. Additionally, two other significant compounds were identified: cyclohexanol, 1-methyl-4-(1-methylethyl)-, which is a tertiary alcohol (7.9±0.02 %) and phthalic acid, isobutyl 4-octyl ester (7.2±0.03 %).

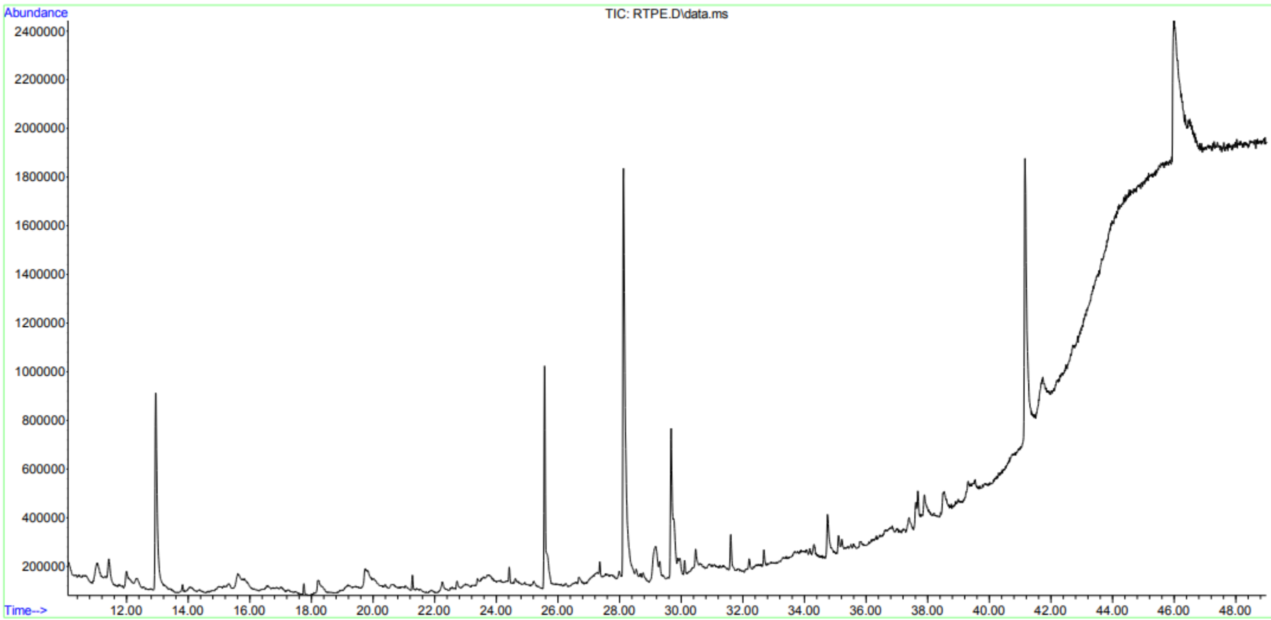


**Figure 4** – Chromatogram of *Rheum tataricum* L. petroleum ether extract

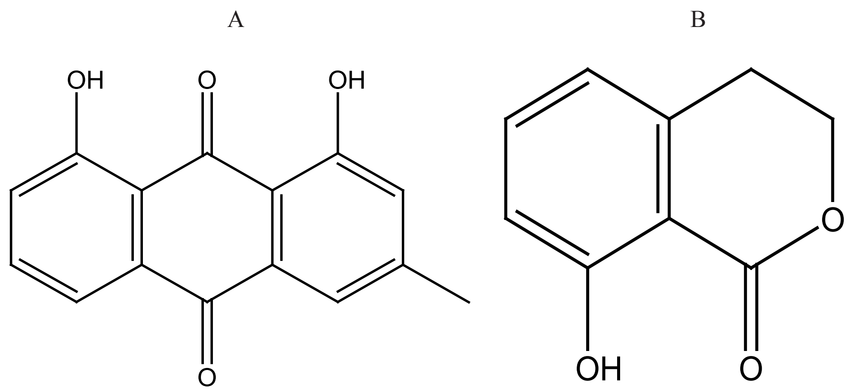


**Figure 5** – Structures of Chrysophanol **(A)** and 1H-2-Benzopyran-1-one, 3,4-dihydro-8-hydroxy-3-methyl- **(B)**

Apocynin (3.1±0.01 %) is a naturally occurring acetophenone that has demonstrated potential in alleviating a range of disorders, such as diabetic complications, neurodegenerative diseases, cardiovascular conditions, lung cancer, hepatocellular carcinoma, pancreatic cancer, and pheochromocytoma [24].

Orcinol (2.1±0.01%) is a naturally occurring phenolic compound found in lichens and plants and is widely used for detecting pentoses in Bial's test. It has been assessed for its antioxidant properties against 1,1-diphenyl-2-picrylhydrazyl (DPPH), as well as its antiradical activity [25, 26].

## Conclusion

This study provides a comprehensive comparative analysis of *Rheum tataricum* and *Rheum palmatum*, focusing on their morphological characteristics, chemical compositions, pharmacological effects, and potential applications in the pharmaceutical industry. These comparative findings, reported for the first time, demonstrate that *Rheum tataricum* contains significantly higher levels of several biologically active compounds compared to *Rheum palmatum*. Notably, the polysaccharide content in *R. tataricum* reached 6.36%, more than three times higher than in *R. palmatum* (2.07%), while tannins were present at 7.40% versus 3.67%. Additionally, coumarin levels in *R. tataricum* were 3.64% compared to 2.40% in *R. palmatum*. These elevated values suggest that *R. tataricum* may have greater therapeutic potential, particularly in supporting immune function, gastrointestinal health, and cardiovascular protection, emphasizing the need for further pharmacological and clinical studies.

Through GC-MS analysis, the key differences in the chemical composition of two *Rheum* species were identified. Notably, *Rheum tataricum*, collected from Kazakhstan, exhibited a high content of biologically active compounds such as chrysophanol, 1H-2-Benzopyran-1-one, 3,4-dihydro-8-hydroxy-3-methyl-, and Cyclohexanol, 1-methyl-4-(1-methylethyl)-, which demonstrates significant antioxidant, antibacterial, and anticancer properties. The increased presence of these compounds suggests that *R. tataricum* is rich in phytochemicals and possesses strong pharmacological potential comparable to or even exceeding that of *Rheum palmatum*.

Given the similar therapeutic effects and the abundance of *Rheum tataricum* in Kazakhstan, this species presents itself as a viable alternative to *R. palmatum* in the domestic pharmaceutical market. Its cultivation and utilization could reduce dependence on imported Chinese rhubarb, thereby promoting local production and enhancing the sustainability of Kazakhstan's medicinal plant industry. Furthermore, the economic and ecological benefits of utilizing a native species align with the growing global trend toward the use of regionally sourced natural products in pharmaceutical applications.

In conclusion, our study highlights the potential of *Rheum tataricum* as a valuable medicinal resource with applications in drug development and traditional medicine. Future research should focus on further pharmacological testing, optimization of extraction methods, and clinical studies to fully unlock its therapeutic potential and establish it as a cornerstone of Kazakhstan's pharmaceutical industry.

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**Conflict of interest**

All authors are aware of the article's content and declare no conflict of interest.

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