Ethnomedicinal and nutritional applications of *Rheum maximowiczii* Losinsk. in traditional medicine in Uzbekistan

Abdulla Rakhmataliev, Azizbek Togaev, Ibrokhimjon Ergashov, Ziyoviddin Yusupov

Correspondence

Abdulla Rakhmataliev[1], Azizbek Togaev[2], Ibrokhimjon Ergashov[3], Ziyoviddin Yusupov[3*]

[1]Research Institute of Environment and Nature Conservation Technologies, Ministry of Ecology, Environmental Protection and Climate Change of the Republic of Uzbekistan, 2 Chimkent road, Darkhan str., Tashkent region, Tashkent district, 111104, Uzbekisan.
[2]Termiz University of Economics and Service, 38-B, Ibn Sino str., Termiz region, Surkhandarya district, 190111, Uzbekistan.
[3]Institute of Botany, Academy of Sciences of Uzbekistan, 32 Durman str., Tashkent, 100125, Uzbekistan.

*Corresponding Author: ziyo-nur87@mail.ru

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Research

Abstract

Background: The aim of this study was to examine the use of *Rheum maximowiczii* Losinsk. in traditional medicine and to assess its role as a food source.

Methods: Information was obtained through fieldwork conducted in natural habitats, a comprehensive review of relevant literature, and ethnobotanical surveys and interviews with local communities and traditional healers.

Results: As a result of scientific studies conducted on *Rheum maximowiczii*, it was found that the root of the plant contains anthraquinone glycosides such as emodin and rhein, while its leaves contain the flavonoid rutin as a bioactive compound. The anthraquinone glycosides were found to enhance intestinal peristalsis and exhibit a laxative effect, whereas rutin demonstrated antioxidant, anti-inflammatory, and capillary-strengthening properties. During the study, it was revealed that in traditional medicine, ointments made from the root of this species are used to treat ailments such as constipation and diarrhea. It was also found that ointments containing this herb are available in pharmacies, and the local population enjoys consuming it in spring.

Conclusions: The presence of bioactive compounds in R. maximowiczii indicates its potential as an important source for the development of pharmaceutical products. The consumption of its stems also suggests that it contains low levels of toxic substances and is safe for human health. Therefore, establishing plantations of this plant may prove to be beneficial. Both the stems and roots of the plant can be used to produce valuable food and medicinal products.

Keywords: Uzbek traditional medicine, *Rheum maximowiczii*, red rhubarb, medicinal plant, diseases, rhizome.

Background

Humans have been using various plant parts to treat diseases since ancient times (Askarov 2022). There are 56 species of the genus *Rheum* L. (Polygonaceae) worldwide, found in China, Uzbekistan, Turkey, and many other countries (Plants of the World Online 2025; Sanchez *et al.* 2011). *Rheum officinale* Baill., *Rheum palmatum* L., *Rheum tanguticum* (Maxim. ex Regel) Balf. are used as medicinal plants in China, *Rheum ribes* L. in Turkey and *Rheum maximowiczii* Losinsk. in Uzbekistan in traditional medicine, pharmacy and medicine (He *et al.* 2024). The names "**大黄**" (*dà huáng*) and "**掌叶大黄**" (*zhǎng yè dà huáng*) for *Rheum palmatum* in China (Zhou *et al.* 2011), "**rovoch**" for *Rheum maximowiczii* in Uzbekistan (Kosimov *et al.* 2023), and "**Işkın**, **ışkın**, **ıçgın**, **ıçkın**, **uçkun**, **uçgun**, **uşgun**, **uşkun**, **aşgın**, **aşkın**, **eşkin**, **eşgin**" for *Rheum ribes* in Turkey are well-known and commonly used among the local populations (Gecibesler *et al.* 2021; Tozlu & Tatar 2019). Among the approximately 4,500 plant species found in Uzbekistan, around 200 species are traditionally used in daily life for food and nutrition (Zakirov 1989; Egamberdiyeva & Jabborova 2018). *R. maximowiczii* (Maximovich rhubarb) is recognized as a particularly valuable medicinal plant native to Uzbekistan (Abdullaeva 2018; Kurbanov & Khamidov 2004; Fig. 1).

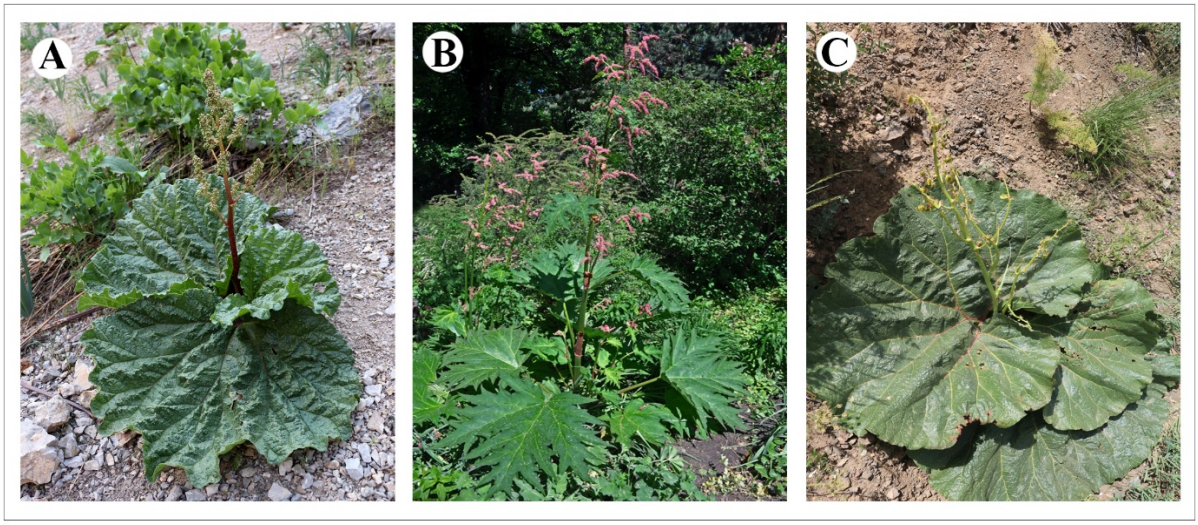

Figure 1. The well-known medicinal species of the genus *Rheum* L.: A) *R. maximowiczii* in Uzbekistan (photo by N. Beshko), B) *R. palmatum* in China (photo by M. Skotnikova), D) *R. ribes* in Turkey (photo by N. Abbasov).

R. maximowiczii is a perennial herb, 40-100 cm tall. Its steam is erect, reddish, its branching arising at an angle of about 45° and forming a large pyramidal inflorescence. It grows on mountain slopes (Komarov 1970). This species is widespread in the natural flora of mountainous and foothill regions and has long been used in Uzbek traditional medicine to treat various diseases, such as diarrhea, constipation, and disorders of the digestive tract (He *et al.* 2024; Abdullaeva 2018; Kurbanov & Khamidov 2004; Khojimatov *et al.* 2020). The sultan of medical science, Avicenna (ca. 970-1037), used rhubarb root as a medicine to treat intestinal bleeding, kidney, bladder, and uterine pain, and stop diarrhea. According to Umarov, a decoction of rhubarb root boiled in milk is used to treat stomach, intestinal, and heart diseases (Umarov 2010). Its underground part, the rhizome, is particularly rich in biologically active substances, including anthraquinones, tannins, flavonoids, and other chemical compounds (Pavlov 1958; Grudzinskaya 1981). The pharmacological properties of these substances are associated with their appetite-stimulating, anti-inflammatory, liver-supporting, antiparasitic, and external wound-healing effects (Kurbanov & Khamidov 2004; Grudzinskaya 1981; Sultankhodjaev & Shomurodov 1997). In Uzbek traditional medicine, the roots of *R. maximowiczii* are mainly prepared as a decoction, a tincture, or raw form and used for internal and external treatments. Due to its widespread use among the people, its occurrence in nature, and its medicinal properties, this species still holds an important place in traditional medicine (Abdullaeva 2018; Sultankhodjaev & Shomurodov 1997).

The root is used to treat skin diseases, the seeds and roots of the medicinal plant are used as a fever reducer, and the stem and branches of the barra are used as an appetite stimulant. Gastrointestinal diseases are common in hot regions. These diseases are characterized by digestive disorders and impaired gastric function (inflammation of the gastric mucosa (gastritis), gastric and duodenal ulcers, inflammation of the mucous membrane of the small and large intestines (enteritis, colitis). The medicines used to treat these diseases should have properties that accelerate wound healing, stimulate appetite, and promote bowel movements. Among the plants with this property is the Maximovich rhubarb (Abdieva 2023). A mixture

of rhubarb root mixed with vinegar applied to the face removes blemishes and freckles (Umarov 2010). It is recommended for patients with diarrhea and jaundice to eat it (Makhmud Khasaniy 2016).

The purpose of the research conducted on this medicinal plant is: (1) to shed more light on the medicinal properties of *R. maximowiczii*; (2) to recommend its use and consumption as a Uzbek traditional medicine for patients with diseases; (3) to provide information about the beneficial substances excisted in the plant for human health in the field of pharmacology in Uzbekistan; (4) to provide information about the sale of medicines made from the medicinal rhubarb plant in pharmacies in Uzbekistan in order to maintain public health. This scientific and practical research will be of great importance in future pharmacological research.

Materials and Methods

Study area

This research was conducted over a four-month period from March to June in both 2024 and 2025, covering the foothill and mountainous regions of Uzbekistan. Interviews with local residents were conducted in Burchmulla village and the nearby Kulosisoy slopes in Tashkent region; in the villages of Kyzylbash, Kyzylturuk, Amankutan, and Takhtakaracha pass in Urgut district of Samarkand region; in Amankutan and Takhtakaracha pass villages of Kitob district in Kashkadarya region; and in the villages of Sangardak, Bakhcha, and Khonjizza of Sariosiyo district in Surkhandarya region (Fig. 2).

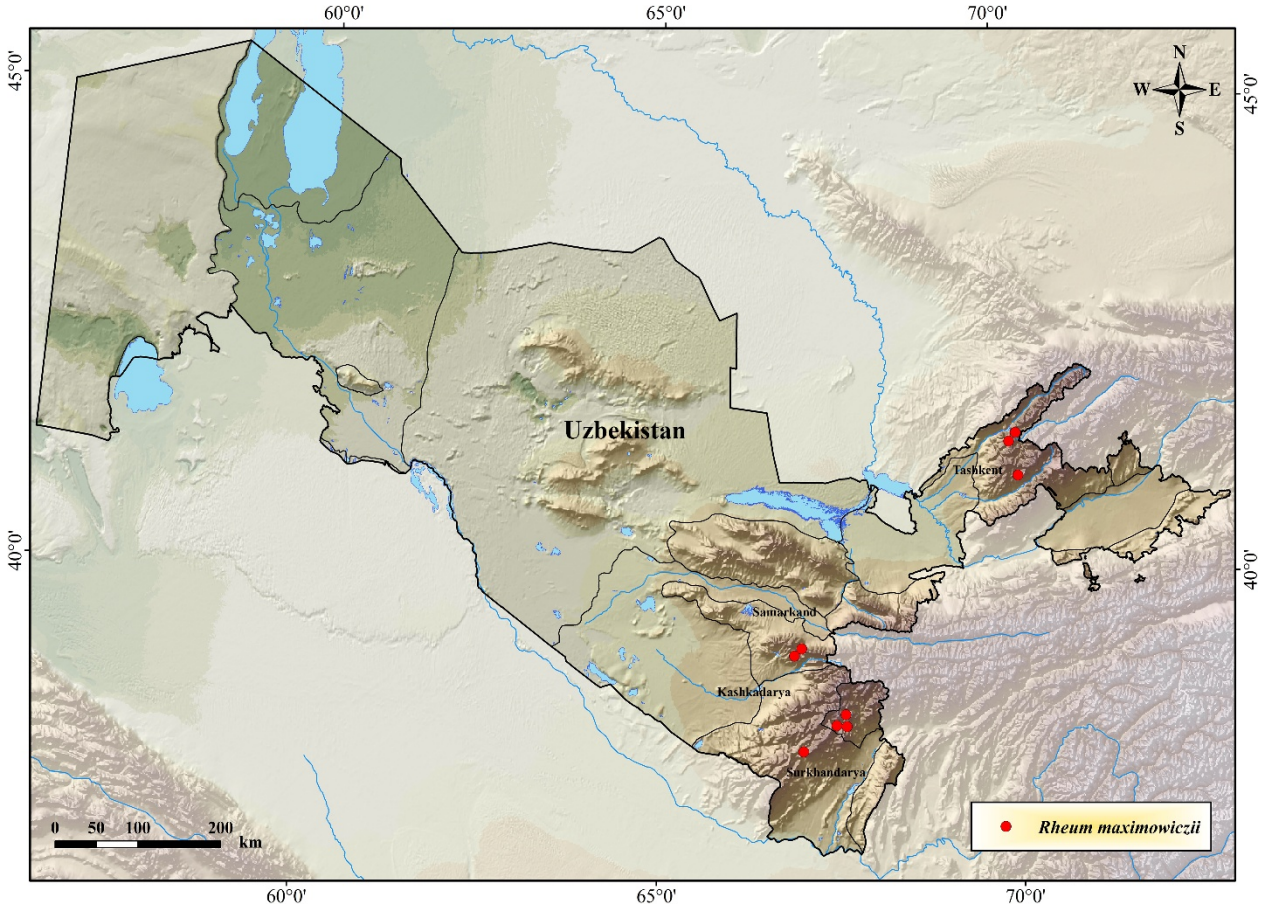

Figure 2. Regions across Uzbekistan where field research was conducted.

Collection of ethnobotanical data

In this study, several scientific and methodological approaches were applied to investigate the traditional use of *R. maximowiczii* in folk medicine of Uzbekistan, including the collection of ethnobotanical data, analysis of literature-based information, and field research methods conducted during 2024-2025. Ethnobotanical data were collected through interviews with local residents and traditional healers, direct observations, and field conversations in the foothill and mountainous regions of Uzbekistan (Martin 1995), particularly in rural areas of Tashkent, Samarkand, Kashkadarya, and Surkhandarya provinces (Fig. 2). During the interviews, traditional healers were asked about the purposes for which they use *R. maximowiczii*, the plant parts they utilize, preparation methods, and the types of illnesses it is used to treat. Furthermore, literature sources containing ethnobotanical information on the traditional use of *R. maximowiczii* in folk medicine were

reviewed and analyzed. All collected data from various sources were cross-examined using comparative analysis. This approach allowed for the identification of similarities and differences between traditional knowledge and scientific literature. As a result, the traditional applications and medicinal significance of this species were clarified in more detail.

Data analysis

The specimen of *R. maximowiczii* preserved in the TASH herbarium of the Institute of Botany, Academy of Sciences of Uzbekistan, was examined at the species level, and its distribution range was clarified. The geographic coordinates represent the natural occurrence points of the plant species as well as the areas covered during the field expeditions. These points were identified using the Google Maps (https://maps.google.com), iNaturalist (https://www.inaturalist.org) platforms, and the Google Earth software (Pro 7.3). The map of the ethnobotanical expeditions and targeted field studies conducted in the territory of Uzbekistan was created using from ArcGIS 10.8.2 software (Fig. 2). All species names of belonging to the genus *Rheum* L. were standardized according to the accepted nomenclature provided by the Plants of the World Online (POWO) platform (Plants of the World Online 2025). To facilitate understanding, artificial intelligence (AI) was used to illustrate the step-by-step preparation process of an infusion made from the root of Rheum maximowiczii for the treatment of constipation and normalizing high blood pressure (Fig. 3).

Results and Discussion

Recommendation for use and consumption by patients

Maksimovich rhubarb is one of the wild medicinal plants found in the foothills and mountainous regions of Uzbekistan (Abdullaeva 2018; Komarov 1970). This species has long been used in Uzbek traditional medicine for the following purposes:
As a digestive aid: its rhizome contains medicinal substances, and this property of the plant has been used as a laxative. It is most often used for constipation, especially in children and the elderly (Abdullaeva 2018). The stem of the rhubarb plant is rich in vitamins, and the plant is considered beneficial for both vitamin deficiency and digestion (Khojimatov *et al.* 2015).
As an anti-inflammatory: In Uzbek traditional medicine, the rhizome has been used to prepare preparations with anti-inflammatory properties. In particular, a decoction of rhubarb root has been used for inflammation of internal organs (stomach, liver, intestines). A decoction or infusion of rhubarb has choleretic properties, improving the function of the liver and gallbladder, and is popularly recognized as a liver cleanser. Powders made from rhubarb were used as an ointment on external wounds of the human body, which accelerated the drying and healing of wounds (Kurbanov & Khamidov 2004; Grudzinskaya 1981).

Beneficial substances to human health

The rhizome of rhubarb contains anthraquinone glycosides (emodin, rhein, etc.), which increase intestinal peristalsis. For this reason, it was used as a laxative. It was most used for constipation, especially in children and the elderly (Grudzinskaya 1981). Anthraquinones protect cells from the effects of free radicals, which is important in slowing down the aging process and maintaining cardiovascular health (Sultankhodjaev & Shomurodov 1997). Some anthraquinones have shown activity against bacteria (e.g., Staphylococcus aureus) and fungi (e.g., Candida albicans). Therefore, they are of interest as natural antimicrobial agents (Zhang *et al.* 2014).

Emodin and its derivatives inhibit the production of inflammatory mediators (e.g., TNF-α, IL-6). This makes them useful in cases of inflammation in the gastrointestinal tract, liver, and kidneys (Sultankhodjaev & Shomurodov 1997; Lin *et al.* 2010). Emodin and rhein have been found to inhibit the growth of cancer cells and stimulate apoptosis (a mechanism of cell suicide). They have been studied particularly in models of colon, breast, and liver cancer (Lin *et al.* 2009; Srinivas *et al.* 2007).

It has been found that rutin and organic acids are present in the leaves and flowers of Maksimovich rhubarb (Kholmatov & Akhmedov 2007). Rutin strengthens capillary walls and reduces their fragility (Xue *et al.* 2023). Rutin improves blood circulation and helps lower blood pressure (Biggers & Gotter 2022). Having a positive effect on diabetes, rutin can increase insulin sensitivity and help maintain normal glucose levels (Semwal *et al.* 2022).

Preparation of ointments by Uzbek traditional healers

Rhubarb preparations are used to soften the stool in chronic gastrointestinal diseases, to stimulate intestinal peristalsis and to relieve gas (Grudzinskaya 1981). For this purpose, when taken in low doses until 0.05-0.2 mg, the drugs have astringent properties (mainly due to the effect of tanoglycosides), and when taken in high doses until 0.5-2.0 mg, they soften the intestines (mainly due to the effect of anthracene derivatives) (Kholmatov & Akhmedov 2007). Uzbek traditional healers peel and chop rhubarb roots, dry them, and steep them in milk. This tincture is drunk as a treatment for many internal diseases, in particular, it is said to have a beneficial effect on the human stomach and heart, and to stop bleeding (Muxtorov &

Najmiddinov 2009; Abdullayev 2022). According to Avicenna (ca. 970-1037), rhubarb is very beneficial in cases of uterine bleeding, asthma, intestinal inflammation, and kidney and bladder diseases (Muxtorov & Najmiddinov 2009).

During the study, interviews were conducted with local residents in the Surkhandarya region, with a traditional healer named Talat in the Samarkand region, and with Tohir traditional healer in Tashkent regarding the traditional products of the *R. maximowiczii* plant. According to Tokhir traditional healer, *R. maximowiczii* is used to prepare complex medicines by cleaning and grinding its roots. He says that it is an effective herb for purifying the blood in the human body, improving peristaltic movements in the intestines, and relieving constipation or diarrhea (Fig. 4 F). According to local residents of Surkhandarya, in spring they consume *R. maximowiczii* as a vitamin-rich, appetite-stimulating herb, and occasionally use its crushed leaves and petioles to promote faster healing of wounds in cases of external skin injuries. Local residents of Tashkent say that there are two types of rhubarb: red and white. Red rhubarb is tastier, while white one is slightly more bitter.

For constipation: Uzbek traditional healer - Talat Abdullaev states that rhubarb root should be finely chopped and taken in the amount of two tablespoons. Mix it with one cup of boiling water and brew it like tea. The finished tincture is drunk in the amount of one third of a glass before bedtime. This decoction is drunk until constipation (difficult and painful bowel movements or no bowel movements for three days) is cured (Fig. 3 A).

The herbal tea made from rhubarb is also useful for high blood pressure. The herbal tea is prepared as follows: two tablespoons of rhubarb root are crushed, added to 150 ml of boiling water, and mixed. This mixture is boiled over low heat for 30 minutes and then cooled. This infusion, when drunk throughout the day, is enough to normalize blood pressure (Abdullayev 2022; Fig. 3 B).

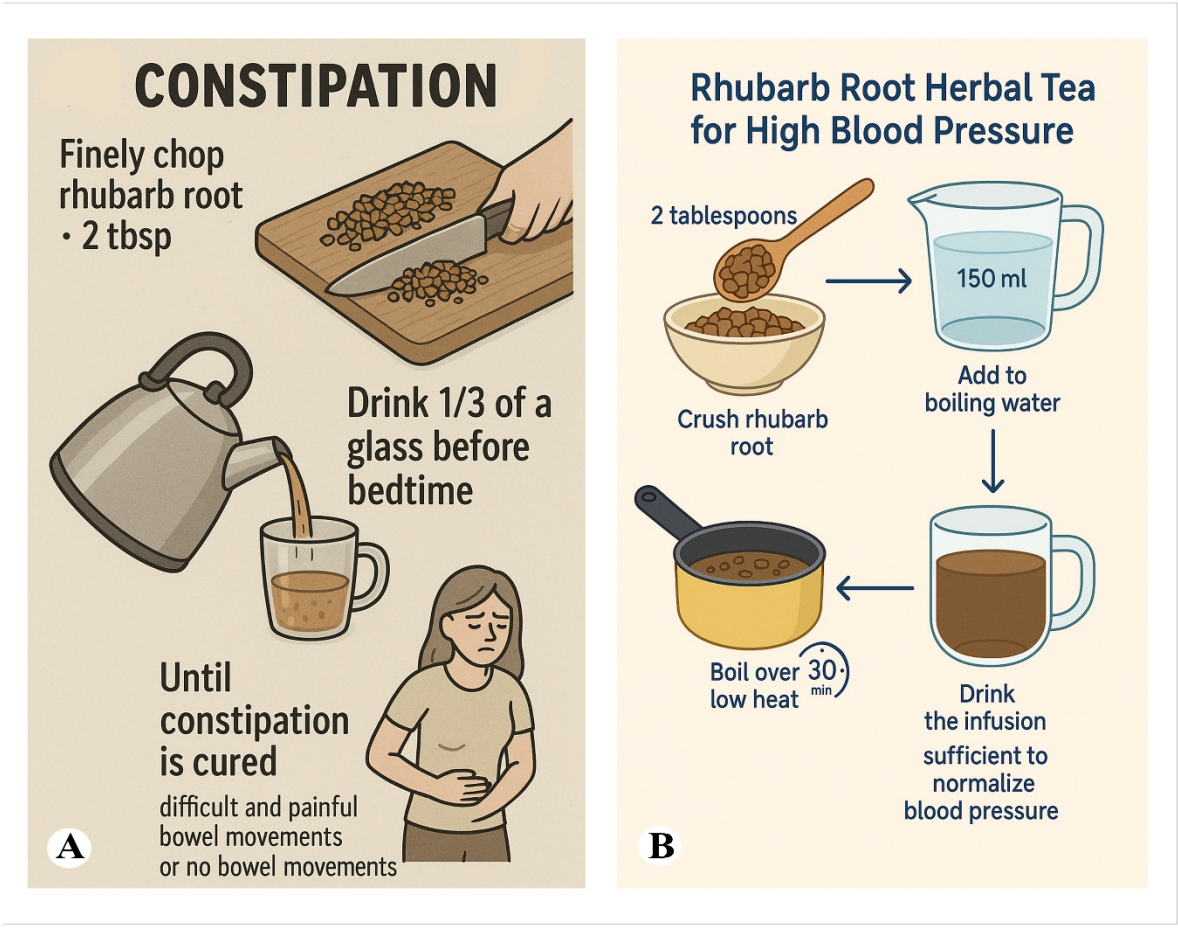

Figure 3. The use of *Rheum maximowiczii* In Uzbek traditional medicine for constipation (A) and improving blood pressure (B).

Providing pharmacies with herbal medicines to maintain public health

During the research, it was found that the Maksimovich rhubarb, known by the local population as red rhubarb, is harvested from the slopes of the mountains in late March and April, before it forms a flower bud, and its juicy and unique-tasting stems

are planted in Surkhandarya, Kashkadarya, and Tashkent for consumption and sometimes even sold. The most common type of rhubarb throughout Uzbekistan is the Maximovich rhubarb, and local residents living in mountainous areas sell stems collected from populations of the plant in April and May (Fig. 4 E). Even medicines made from rhubarb and other herbs are available in pharmacy chains across Uzbekistan, priced at $2.7 - $31.08 in US dollars (Table 1).

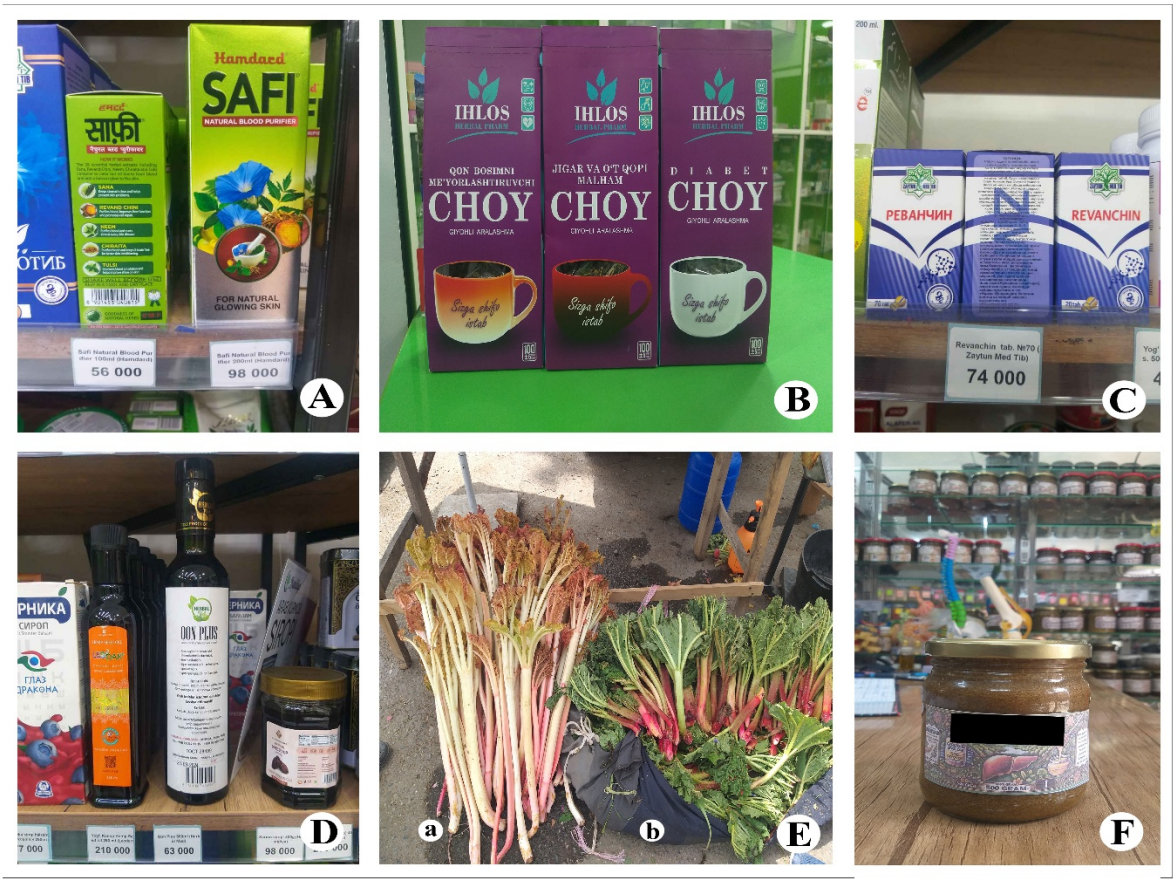

Figure 4. Medicinal products made from Rheum maximowiczii are available for sale. A) Safi - natural blood purifier. B) Tea herbal mixture. C) Revanchin tablets. D) Qon plus. E) Juicy petioles of rhubarb: a) the rhubarb grown with human intervention; b) the rhubarb grown without human intervention in natural habitat. F) The complex herbal medicine prepared by Tokhir traditional healer. These medicines are available for sale in pharmacy chains throughout Uzbekistan, except for E & F.

Table 1. Medicinal products, both traditional and pharmaceutical, containing *R. maximowiczii*.

Figure 4	Products used as traditional medicine	Cost (in UZS soums)	Cost (in US dollars)
A	Safi	98000 soums	7.6 $
B	Tea herbal mixture	40000 soums	3.1 $
C	Revanchin tablets	74000 soums	5.75 $
D	Qon plus	63000 soums	4.9 $
E	Juicy petioles of rhubarb	35000 soums	2.7 $
F	The complex herbal medicine prepared by Tokhir traditional healer	400000 soums	31.08 $

There are cases where it is not recommended for patients

In some diseases related to the stomach and intestines, pregnant women are prohibited from consuming or taking medicines made from rhubarb without the advice of doctors and traditional healers.

Conclusion

The study revealed that *Rheum maximowiczii* is a widespread species in Uzbekistan. This is a medicinal plant, and during research, the local population, who know the species *Rheum maximowiczii* as red rhubarb, picks it from the mountain slopes in the spring and eats it. Among local and national healers, this plant is considered a useful herb for preparing ointments for patients suffering from various diseases. The herb is also mentioned in the works of Avicenna (ca. 970-1037) in the preparation of many complex medicines. The biologically active compounds in the plant have been identified through various biochemical analyses. A clear indication of this is the use of ointments prepared in combination with other medicinal plants, which are considered beneficial for treating constipation, healing external skin wounds, improving liver and gallbladder function, stimulating stomach and intestinal activity, and supporting the cardiovascular system. In conclusion, the consumption of the species *Rheum maximowiczii* indicates that its toxicity level for the human body is low. Therefore, it is recommended to establish plantations for food and medicinal purposes without negatively impacting the populations of the plant in nature. Although the use of this species in Uzbek traditional medicine is well known and widespread, there is insufficient information regarding its ecology, biology, and the organization of its cultivation. The data collected during this study will serve as an important initial source for future research.

Declarations

List of abbreviations: *R. maximowiczii*: *Rheum maximowiczii*; TASH: The herbarium collection of the Institute of Botany in Tashkent; POWO: The Plants of the World Online.

Ethics approval and consent to participate: All participants provided oral prior informed consent.

Consent for publication: The remedy shown in Fig. 4, labeled with “F”, was prepared by a traditional healer who did not wish to disclose its name. Consent for publication was obtained for all other images.

Availability of data and materials: All the data are presented in tables in the manuscript and are available with the corresponding authors.

Competing interests: The authors declare that they have no competing interests.

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Author contributions: A.R., A.T., I.E. designed the study, conducted ethnobotanical surveys, collected, analyzed the data and actively participated in the development of the methodology, wrote the manuscript, and performed data analysis and interpretation. Z.Y. supervised the work, and advised, reviewed, contributed to the methodology, and improved the manuscript.

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