

# Taxonomic Revision of the Genus *Rhaponticum* (Asteraceae) of Kazakhstan

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**Abstract:** An overview of the genus *Rhaponticum* Vaill. is presented, as growing on the vast territory of Kazakhstan. The study is based on field materials, literature and accurate revision of herbarium materials. Data from more than 240 herbarium specimens stored in herbarium collections were analyzed: LE, AA, MW, TASH, KUZ, KG, NUR and MANG. The article provides illustrations and data on the general distribution, ecological occurrence, phenology and environmental status of *Rhaponticum* species growing in Kazakhstan. In addition, detailed distribution maps and taxonomic keys for each species have been compiled. In total, 6 species of *Rhaponticum* grow in Kazakhstan, 3 of which (*Rh. carthamoides*, *Rh. aulieatense* and *Rh. karatavicum*) are included in the red book of Kazakhstan. According to the results obtained, the most common species in Kazakhstan are *Rh. altaicum* (57 locations in 13 Floristic Regions (FR)) and *Rh. nitidum* (56 locations in 9 FR). As a result of the conducted research *Rh. nitidum* was first found on the territory of Northern Usturt, *Rh. altaicum* was discovered on the Tarbagatai. Also, the growth of *Rh. altaicum* in the Eastern Upland, Bukeev floristic region and Ulutau are not confirmed by herbarium materials. These species were relatively rare: *Rh. carthamoides* (32 locations in 3 FR), *Rh. aulieatense* (12 locations in 2 FR) and *Rh. karatavicum* (27 locations in 1 FR). *Rh. namanganicum* (found only in two localities in the Western Tien Shan) is recommended for inclusion in the next edition of the Red Book of Kazakhstan. According to the data obtained, further study of the number and status of populations of *Rhaponticum* species on the territory of Kazakhstan is required to revise their conservation status.

**Keywords:** Flora of Kazakhstan, Species Distribution, Growing Conditions, Conservation Status, Diagnostic Key, *Stemmacantha*, *Leuzea*

## Introduction

Taxonomy of the genus *Rhaponticum* is extremely confusing and has been repeatedly discussed by many taxonomists (Holub, 1973; Dittrich, 1984; Kamelin, 1998; Vorobyeva and Gorovoy, 2010; Kadereit, 2007; Özbek, 2022) including those based on molecular (Garcia-Jacas *et al.*, 2001; Hidalgo *et al.*, 2006; Susanna *et al.*, 2006; Boqin *et al.*, 2022) and karyological (Hellwig, 1994; Garcia-Jacas *et al.*, 1996; 1998; Vilatersana *et al.*, 2000; Hidalgo *et al.*, 2007) studies. In modern scientific literature, the same species representatives are classified into 3 genera: *Rhaponticum*, *Leuzea* DC and *Stemmacantha* Cass.

We believe that phylogenetic associations between *Rhaponticum* species separated by large distances and having no common ancestry cannot be inferred from the results of molecular and genetic studies alone. According to Hellwig (2004), the first stage of separation in the *Rhaponticum* group happened 15-25 million years ago.

As the artificiality of taxonomy constructs became apparent, it was recognized that data from DNA analysis of pollen and chloroplasts did not eliminate the need for other methods to study historical relationships in the genus *Rhaponticum*. In addition to genetic studies, a combination of various botanical and biochemical studies is important for taxonomy purposes. A new classification system (Bremer, 1994; Greuter, 2003; Greuter *et al.*, 2005)

restores the genus *Rhaponticum* based on the morphological and anatomical structure of organs, tissues and cells, phytochemical composition of the studied plants. The historically restored group *Rhaponticum* includes plants previously assigned into the genera *Rhaponticum*, *Leuzea* and *Stemmacantha* and also, as synonyms, to the genera *Callicephalus* C. A. Mey., *Acroptilon* Cass., *Fornicium* Cass., *Malacocephalus* Tausch (Hellwig, 2004).

Chemotaxonomic studies of the presence of composition of *ecdysteroids* in plant organs made their contribution to the establishment of the genus system; being one of the cognitive tools for identifying phylogenetic relationships between closely related species, they can bring understanding to the taxonomic relationships of the botanical systematics of the genus. For example, almost all species of *Rhaponticum* (Soskov, 1963), growing in the mountain systems of Central Asia, contain very high levels of *ecdysteroids*. Conversely, there is not a single report in the literature on the discovery of phytoecdysteroids from representatives of *Leuzea* and *Stemmacantha* living on the Iberian Peninsula.

Worldwide, there are 26 species of *Rhaponticum* distributed in Europe, Asia and North Africa (Anderberg *et al.*, 2007; Hellwig, 2004). The greatest species diversity (14 species) is concentrated within the former USSR, as well as in the mountains of Siberia and Central Asia (9 species) (Soskov, 1963; Ganiev, 1980; Postnikov, 1995). There are 6 species found in Kazakhstan: *Rh. carthamoides* (Willd.) Iljin, *Rh. aulieatense* Iljin, *Rh. karatavicum* Regel et Schmalh, *Rh. altaicum* (Fisch. ex Spreng.) Soskov, *Rh. nitidum* Fisch., *Rh. namanganicum* Iljin (Soskov, 1963; Orazova, 1966; Baitenov, 2001; Mamyrova *et al.*, 2023). Of which *Rh. karatavicum* is a national endemic of Kazakhstan (Kupriyanov, 2018, Tojibaev *et al.*, 2020, Kubentayev *et al.*, 2024).

Some species of *Rhaponticum* including *Rh. acaule* (L.) DC., *Rh. carthamoides*, *Rh. altaicum*, *Rh. uniflorum* (L.) DC. have valuable medicinal properties and are an important source of *ecdysteroids* and other useful natural compounds (Buděšínský *et al.*, 2008; Kokoska and Janovska, 2009; Havlik *et al.*, 2009; Chen *et al.*, 2017; Skala *et al.*, 2016; Wu *et al.*, 2017; Mosbah *et al.*, 2018; Zughdani *et al.*, 2020; Roumanille *et al.*, 2020; Das *et al.*, 2021; Kosović *et al.*, 2022; Zheng *et al.*, 2022; Olennikov, 2022; Hammoudi *et al.*, 2023; Todorova *et al.*, 2023).

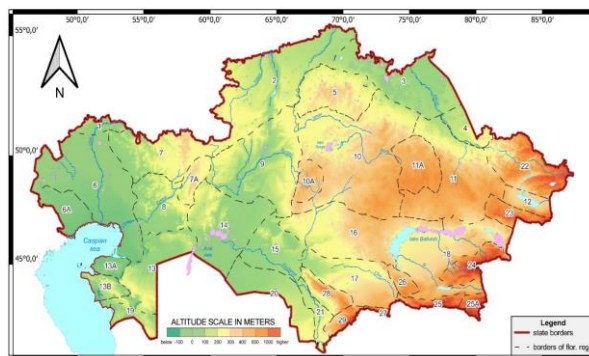
Due to the confusing systematic position of the genus, to the conservation status of *Rh. carthamoides*, *Rh. aulieatense*, *Rh. karatavicum* (Baitulin, 2014), to the special economic value of *Rh. carthamoides* and poor knowledge of the distribution of the genus *Rhaponticum*, we decided to make a detailed review of this genus within the Flora of Kazakhstan. The main purpose of this study is to research the species diversity and distribution of species of the genus *Rhaponticum* on the vast territory of Kazakhstan, based on a revision of herbarium materials, literature data and field observations.

## Materials and Methods

The present study was based on the data obtained from publications and the following herbaria: LE, AA, MW, TK, TASH, KUZ, KG, NUR and MANG the acronyms are according to Thiers (2022). The study was complemented by the results of the fieldwork in the Western Tian Shan (1997-2003) and in the Karaganda and Akmola regions (2022-2023). The field materials allowed for a detailed description of the *Rhaponticum* species distribution range in Kazakhstan.

The distribution of plants on the territory of Kazakhstan is shown according to Floristic Regions (FR) developed by N.V. Pavlov, I. A. Lynchevsky, N.I. Rubtsov and P.P. Polyakov, detailed and clarified by M.G. Popov for the Flora of Kazakhstan (Flora of Kazakhstan, 1956). This zoning can be considered successful since it reflects climatogenic regional (meridial according to Komarov) differences in vegetation cover, as well as regional ones, associated primarily with the orography of the territories. In total, 29 floristic regions, or 35 territorial units (taking into account the subdistricts), have been established for Kazakhstan (Fig. 1).

When compiling a summary, we follow the monotypic concept of the genus proposed by Komarov (1944); Kamelin (2004). The structure of the genus and the volume of taxa in the summary below are done according to the system of the genus *Rhaponticum* developed by Soskov (1963) and according to Plants of the World Online (POWO, 2023).



**Fig. 1:** Map of the floristic division of Kazakhstan (Pavlov, 1956):

1 -Syrtd, 2-Tobol-Ishim, 3-Irtysh, 4-Semipalatinsk pine forest, 5- Kokchetav, 6-Caspian Region, 6a-Bukeev, 7-Aktobe, 7a- Mugojar, 8-Emba, 9-Turgay, 10-Western upland, 10a - Ulutau, 11 - Eastern Upland, 11a - Karkaraly, 12 - Zaysan, 13 - Northern Ustyrt, 13a - Buzachi, 13b - Mangyshlak, 14 - Aral Region, 15 - Kyzylorda, 16 - Betpak -Dala, 17 - Moynkum, 18 - Balkhash-Alakol, 19 - Southern Ustyrt, 20 - Kyzylkum, 21 - Turkestan, 22 - Altai, 23 - Tarbagatai, 24 - Dzungarian Alatau, 25 - Trans-Ili Kungey Alatau, 25a - Ketmen-Terskey Alatau, 26 - Chulli Range, 27 - Kyrgyz Alatau, 28 - Karatau, 29 - Western Tian Shan

The environmental status corresponds to the Red Book of Kazakhstan (Baitulin, 2014), which identifies the following categories: I-very rare, critically endangered species, II-rare species, III-species with declining numbers.

## Results and Discussion

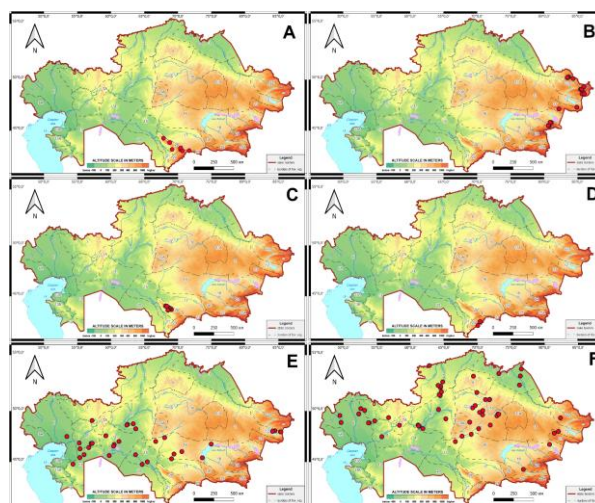
In Kazakhstan, there are two sections of *Rhaponticum* including *Fornicum* and *Rhaponticellum* (Soskov). Three species are listed as threatened in the Red Book of Kazakhstan (Baitulin, 2014): *Rh. carthamoides*, *Rh. aulieatense* and *Rh. karatavicum*. In the studied region, the most widespread species are *Rh. altaicum* (57 locations in 13 FR) and *Rh. nitidum* (56 locations in 9 FR). Relatively rare are *Rh. carthamoides* (32 locations in 3 FR), *Rh. aulieatense* (12 locations in 2 FR) and *Rh. karatavicum* (27 locations in 1 FR). An extremely rare species of *Rh. namanganicum* (known from 2 localities in the Western Tien Shan) is recommended to be included in the next edition of the Red Book of Kazakhstan (Table 1, Fig. 2).

As a result of the revision of herbarium materials and literary sources, new areas of distribution of species of the genus *Rhaponticum* in the territory of Kazakhstan were identified. *Rh. altaicum* has previously been cited in the literature to be present in the following floristic regions: Eastern Upland, Bukeev and Ulutau (Orazova, 1966; Ishmuratova *et al.*, 2016; Kupriyanov, 2020; Mamyrova *et al.*, 2023). However, we have not come across the herbarium materials confirming the presence of *Rh. altaicum* in these regions. This species has been found on the territory of Tarbagatai relatively recently (Mamyrova, 2023). *Rh. nitidum* has been reported for the first time in Northern Usturt. In the literature (Orazova, 1966, Kupriyanov, 2020), *Rh. nitidum* has been noted to grow in Kokchetav floristic region and Western Upland, however, according to our research, the growth of this species in the territory

of Kokchetav FR has not been confirmed. Growth of *Rh. nitidum* on the territory of the Western upland requires additional field research.

Due to the fact that today only two locations of a small population of Western Tien Shan endemic *Rh. namanganicum* are known on the territory of the Aksu-Dzhabagly state nature reserve and the Sairam-Ugam state National Nature park (Ivashchenko, 1997; 2020), this species is recommended to be included in the next edition of the Red Book of Kazakhstan.

Also, at present, the distribution, size and condition of *Rh. karatavicum* and *Rh. aulieatense* populations within Kazakhstan have not been sufficiently studied, therefore we consider it necessary to conduct special field studies.



**Fig. 2:** Distribution map of species of the genus *Rhaponticum* in Kazakhstan: A *Rh. aulieatense*; b *Rh. carthamoides*; c *Rh. karatavicum*; d *Rh. namanganicum*; e *Rh. nitidum*; f *Rh. altaicum*

**Table 1:** Summary of genus *Rhaponticum* species distribution in Kazakhstan

Species	Number of localities	Floristic regions	Category according to the red book of Kazakhstan
<i>Rhaponticum carthamoides</i> (Willd.) Iljin	32	Altai, Tarbagatai, Dzungarian Alatau	III
<i>Rh. altaicum</i> (Fisch. ex Spreng.) Soskov	57	Tobol-Ishim, Irtysh, Kokchetav, Caspian Region, Aktobe, Mugojar, Turgay, Western Upland, Zaysan, Balkhash-Alakol, Altai, Tarbagatai	-
<i>Rh. nitidum</i> Fisch	56	Caspian Region, Aktobe, Emba, Turgay, Western Upland, Zaysan, Aral Region Northern Usturt, Kyzylorda, Betpak-Dala	-
<i>Rh. karatavicum</i> Regel et Schmalh	27	Karatau	II
<i>Rh. aulieatense</i> Iljin	12	Karatau, Kyrgyz Alatau	II
<i>Rh. namanganicum</i> Iljin	2	Western Tian Shan	-

### Taxonomic Treatment

*Rhaponticum* Vaill., Königl. Akad. Wissensch. Paris Phys. Abh. 5: 177. 1754; Adams., Fam. II 117. 1763; Ditrich, Candolea 39: 45-49. 1984, nomencl:

- *Centaureum* Haller Hist. Stirp. Helv. 1: 69. 1768, nom. illeg
- *Acroptilon* Cass., G.-F. Cuvier, Dict. Sci. Nat., Ed. 2. 50: 464. 1827
- *Fornicium* Cass., Bull. Sci. Soc. Philom. Paris 1819: 93. 1819
- *Klaseopsis* L. Martins, Taxon 55: 974. 2006
- *Leuzea* DC., J.B.A.M.de Lamarck and A.P.de Candolle, Fl. Franç., éd. 3, 4: 109.1805
- *Malacocephalus* Tausch, Flora 11: 481. 1828
- *Rhapontica* Hill, Veg. Syst. 4: 47 1762
- *Stemmacantha* Cass., Bull. Sci. Soc. Philom. Paris 1817: 12. 1817

Type *Rhaponticum scariosum* Lam., Fl. Franç. (Lamarck) 2: 38. 1779.

Description. Perennial herbs. Leaves entire or lobar, pinnately dissected, pubescent abaxially and green adaxially. Synflorescence large, single, multi-flowered. Involucres consist of multirow membranous leaflets with entire or dissected appendages. The receptacle is slightly convex and bristly. Flowers bisexual, violet-purple, rarely yellow, with a tubular corolla, widened in the upper half, cut into five linear lobes. Achenes bare, laterally compressed, oblong, ribbed, attachment area obliquely cut. Pappus two-rowed, always exceeds achene.

Below we present the most important morphological characters used for diagnosing groups and individual species of the genus *Rhaponticum*:

1. The sheath of the lower dead leaves enveloping the stem at the base on the inside may be bare or covered with long hairs. This is an important morphological character that distinguishes section *Fornicium* (Cass.) Soskov from other sections
2. Plants can be stemless or with a short stem up to 30 cm tall, or plants can be 60-100 cm tall. Short stature or the absence of a stem is characteristic of a mid-mountain Asian species classified by Soskov (1963) to the section of *Raponticellum* Soskov
3. The crest consists of rigid, yellowish-reddish, short-pinnate setae or white ones with a small admixture of yellowish color

A key to the Kazakh species of *Rhaponticum*

1. Plants is practically stemless or almost stemless, 3-5 cm tall; sheaths of dead leaves envelop the stem at the base, on the inside covered with long silky-white bristles; pappus consists of yellowish-white setae; leaves pinnately divided into toothed lobules .....*Rh. namanganicum* Iljin.

- Plants up to 10-130 cm tall; sheaths of dead leaves envelop the stem at the base, on the inside covered with long silky-white bristles; pappus consists of yellowish-brown setae .....2

2. Stem leaves elliptical, entire, lower stem leaves entire or pinnate with 1-3 pairs of oblong lobes..... *Rh. altaicum* (Fisch. ex Spreng.) Soskov.

- Stem leaves pinnately dissected.....3

3. Corollas yellow, pappus reddish and rigid; plants completely naked, leaves with cartilaginous teeth.....*Rh. nitidum* Fisch.

- Corollas are pink or purple; entire plants are pubescent.....4.

4. Pappus short pinnate, two-rowed, brownish creamy, 1.5-1.8 cm tall; stems and basal leaves pinnately dissected; mesophilic plants up to 80-150 cm tall.....*Rh. carthamoides* (Willd.) Iljin.

- Pappus with white bristles, about 1.5 cm long, plants almost stemless or 15-40 cm tall.....5

5. Plants whitish with thin dense pubescence, 6-15 cm tall, leaves somewhat curly at the edges.....*Rh. karatavicum* Regel et Schmalh.

- Plants almost green, finely pubescent, 15-40 cm tall, leaf segments often with membranous points.....*Rh. aulieatense* Iljin.

Sect. *Fornicium* (Cass.) Soskov, Fl. USSR, 28: 311. 1961; *Fornicium* Cass., Bull. Soc. Philom. Paris: 93. 1819  
 Type: *Rh. serratuloides* (Georgi) Bobr.

Description. A plant with stems covered at the base with brown, bare sheaths of dead leaves on the inside. The corolla is violet-purple. The tuft is made of short-pinnate setae, never pure white; the dorsum of the setal axis is with more or less slender, sparse rows of hairs allocated as a plain.

*Rhaponticum carthamoides* (Willd.) Iljin, Acta Inst. Bot. Acad. Sci. URSS. Ser.1, 1: 204. 1933; Soskov, in Fl. URSS. 28: 311. 1963; Orazova, Flora Kazakhstana.9: 370. 1966; Machmedov, Opredelitel' rastenij Srednej Azii, 10: 401. 1993 (Figs. 3a-c):

- *Rh. chamarensense* Peschkova, Botanicheskij Zhurnal, 62, 2:227. (1977)
- *Cnicus carthamoides* Willd. Sp. Pl. III: 1685. (1803)
- *Cnicus centauroioides* Willd 1. c. p. p. quoad pl. Sibir.
- *Serratula carthamoides* Poir, Lam. Encycl. VI: 561. (1804)
- *Leuzea carthamoides* (Willd.) DC., Ann. Mus. Hist. natur.16: 205. (1810)
- *Leuzea altaica* Fisch ex Schauer, non M.Bieb. Ex Spreng. (1834-1835)
- *Fornicium carthamoides* (Willd.) R. Kam., Mater. Istorii Fl. Azii: 139. (1998); Zuev, Konsp. Fl. Sib.: 222. (2005)

Type: RUSSIA. Siberia: Coll? Herb. Willdenow – B.N 14953, exemp N 3.



**Fig. 3:** *Rhaponticum carthamoides* in the wild: General view in population (A); blooming inflorescence (anthode) (B); fruit inflorescence (C). Photos by Kubentayev

General distribution: Western Siberia: Altai; Eastern Siberia: Angaro-Sayan floristic region (southwest), Kazakhstan, Mongolia, China.

Habitat and ecology: It can be found within subalpine and alpine meadows, is less common in the adjacent alpine tundra; often descends into the forest belt, growing in high-grass forest meadows and along forest edges.

Conservation status: It is included in the Red Book of Kazakhstan as category III. The species is protected on the territory of the Markakol State Nature Reserve, the West Altai State Nature Reserve, the Katon-Karagay State National Park, Zhongar-Alatau State National Park and Tarbagatai State National Park.

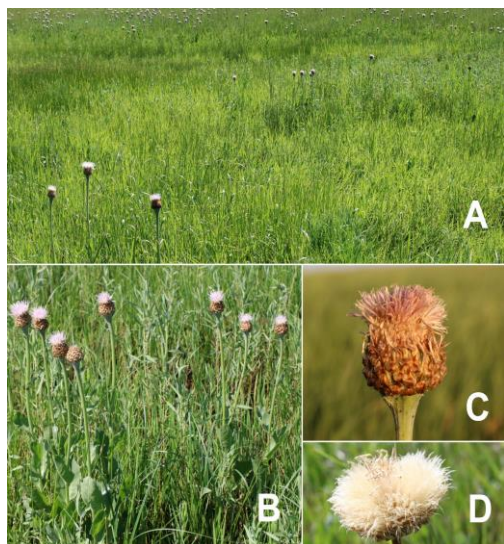
Phenology: Plants bloom in July-August and bear fruit in August-September.

Specimens examined and literature records: ALTAI: Kurchum River valley, on the left side of the Ozernaya River, 31 May 1991, Taizhanov and Beskaraev s.n. (TASH!); near lake Markakol, 3 Aug 1908, Keller s.n. (LE!); Narymskiy ridge, lower Terekty river origins, 29 Jun 1908, Sedelnikov s.n. (LE!); Uspenka-Urunkhaika, 2 Aug 1914, Saposhnikow s.n. (LE!); 4 km from the northeast of mountains Zimovye (reservoir), 16 Aug 1936, Matveeva 218 (LE!); Narymskiy ridge, watershed river systems Bukon and Kurchum, 2600 m, the upper reaches of the Ashi riverpool river Kurchum, 13 Aug 1914, Yacovlev s.n. (LE!); southern lopes pass Cholpan-Daba, 15 Jul 1910, Reznichenko and Reznichenko s.n. (LE!); lower flow stream Matabay - southern part basins lakes Markakol, 28 Jun 1908, Reznichenko 236 (LE!); average part currents rivers Sarymsakty, 5 Jul 1909, Reznichenko and Reznichenko 238 (LE!); same place, 16 Jul 1909, Reznichenko and Reznichenko 338 (LE!); upper

reaches and origins rivers Karatal and Chin-Bulak, 21 Aug 1930, Shipczynski 442 (LE!); in subalpinis and Ulba: In alpinibus Karimensibus et in monte Crucis prope Ridersk, 11 Aug 1840, Karelin and Kirilov 850 (LE!); upper reaches rivers Talyty, 7 Jul 1979, Snegirev s.n. (AA!); Narymskiy ridge, near neighborhood villages Katon-Karagay, 10 Aug 1930, Smirnow 184 (MW0150099!); upper reaches rivers Shibanda, watershed partridge, 4 Jul 1968, Snegirev s.n. (AA!); Southern Lope Mountains "Three brothers", 30 Jul 1937, Almaty botanical detachment Kazakh branch of Academy of Sciences s.n. (AA!); Karakol Belki, 17 Jun 1947, Pologiy s.n. (AA!); valley rivers Tykhaya, 20 Jul 1936, Elenevsky s.n. (MW0150100!); Narymskiy ridge area rivers Balgyndy and Lotoshni, Aug 1923, Charkovsky s.n. (TK!); Ivanovskiy ridge (Prohodnoy belok) (Kubentaev and Danilova, 2017); between Uspenka and Urunhaika, near Lake Markakol, 16 Jul 1928, Krylov and Sergievskaya s.n. (TK!). TARBAGATAI: Saur, watershed rivers Big and Malaya Gemenea, 17 Jul 1930, Goncharov and Borisova 527 (LE!); pass Sai-asu, 21 Jun 1915, Sapozhnikov and Tripolitova s.n. (LE!). DZHUNGARIAN ALATAU: In the upper reaches of Lepsy River, tract Kokzhetsu, 25 Jul 1968, Taizhanov s.n. (TASH!); area Lepsinsk, Sartykt, 12 Aug 1934, Nikitin s.n. (LE); slope mountain hills Kyzasu close to the village of Kolpakovskiy, 2 Jul 1928, Lipschitz s.n. 472 (LE!, AA!, MW0890975!); stingray by the river Zhamanta near village Glinovskiy, 6 Jul 1928, Pavlov 574 (LE!, AA!, MW0890974!); watershed rivers Koksu -Chimbulak (Karatal basin), tract Ak - Tyube, 2300 m, 7 Aug 1948, (Goloskokov, 1997) (LE!, AA!); outskirts of the city Lepsinsk, slope gorges, 20 Jun 1928, Lipschitz 204 (LE!, AA! MW0890976!); mountains to south from Lepsinsk, 2 Jul 1909, Roshevitz 345 (LE!); gorge river Karatal in the neighborhood of Tekeli mine, 23 Jun 1955, Mihai s.n. (AA); at River Kish-Tentek, 9 Jul 1909, Roshevitz s.n. (LE!); Dzungarian Alatau [without detailed locality], 1840, Karelin and Kirilov 850 (MW0890973!) (Fig. 2b).

Notes. *Rh. carthamoides* is a valuable medicinal plant, which is one of the important sources of ecdysteroids and other useful natural compounds (Buděšínský *et al.*, 2008; Kokoska and Janovska, 2009; Havlik *et al.*, 2009; Skala *et al.*, 2016; Wu *et al.*, 2017; Das *et al.*, 2021; Kosović *et al.*, 2022). The species in Kazakhstan grows in subalpine meadows of the ridges of the Kazakhstan Altai, Tarbagatai and Dzungarian Alatau. In the Kazakh Altai, the species has a high abundance and good regeneration (Myrzagaliyeva and Samarkhanova, 2018; Kubentayev *et al.*, 2019; 2023).

*Rhaponticum altaicum* (Fisch. ex Spreng.) Soskov in Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 19: 403 (1959) (Figs. 4a-d).



**Fig. 4:** *Rhaponticum altaicum*: Population; (A), general view; (B), blooming inflorescence (anthode); (C), fruit inflorescence; (D). Photos by S. A. Kubentayev

- *Rhaponticum serratuloides* (Georgi) Bobr., Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 20:19. 1960
- *Leuzea altaica* link., Enum. Hort. Berol. Alt. 2: 356. 1822
- *Fornicium serratuloides* (Georgi) R. Kam., Mater. Istoriï Fl. Azii: 139. 1998; Zuev, Konsp. Fl. Sib.: 222. 2005
- *Stemmacantha serratuloides* (Georgi) Dittrich, Candollea 39: 49. 1984

Type: RUSSIA. Siberia: Gmelin J. G. 1749. Flora Sibirica, 2: Tabl. 37 (lectotype is a picture made by I. Gmelin in "Flora of Siberia").

General distribution: It grows in the European part of Russia, Western Siberia, Central Asia (Kazakhstan), Ukraine, Moldova and Romania.

Habitat and ecology: It grows on salt marshes, solonized soils and saline meadows along the banks of steppe rivers, lakes and lowlands.

Conservation status: This species is currently not assessed by the national red list assessment.

Phenology: Plants bloom in May-June and bear fruits in July-August.

Specimens examined, observations and literature records: TOBOL-ISHIM: Southwestern shore of Lake Selye-Tengiz, 29 Jul 1954, Isachenko s.n. 1742 (LE!); interfluvium of the Toguzak-Ayak rivers, on the slope to Lake Zhubany, 8 Jul 1931, Stukenberg 430 (AA!, LE!); shore of lake Ubagan, 15 Jun 1909, Zelinsky 38 (LE!); same loc., 18 Aug 1925, Rusanov s.n. (LE!). IRTYSH: 10 km southwest of the village of Lvovka, 1 Jul 1955, Tsvelev 731 (LE!); from the village of Mikhailovskiy to Pokrovskiy, 4 Jun 1913, Kucherovskaya 164 (LE!); neighborhood of the village of Lebyazhye, floodplain of the Irtysh,

9 Jun 1975, Prokopiev s.n. (TK!). KOKCHETAV: Along the bottom of the Sur-At ravine 5 km south of the village of Mulytnbaevskiy along the Kokchetav-Akmolinsk highway, 14 Jun 1913, Drobov 495 (LE!). CASPIAN REGION: Saban-mola, 20 km from Kizyl-Kuga, 11 Jun 1927, Ilyin and Grigoriev 253 (AA!, LE!); same loc., 14 Jul 1927, Ilyin and Grigoriev 276 (AA!, LE!); Uzen tract at the dammed end of Sasyk Kul, 17 Jul 1927, Rozhevits and Zhezhel 215 (AA!); Beit tract along Emba, 25 Jun 1927, Nikitin 247 (LE!); between the Bolshaya and Malaya Uzen rivers, 7 km south of Furmanovo, 10 Jun 1955, Grubov and Lyubarsky 12 (LE!); near the Buldurty River, 15 Jun 1927, Rozhevits and Zhezhel 302 (AA!); bank of the Ulekty River, 9 Jul 1927, Rozhevits and Zhezhel 560 (AA!); to the southeast of the village of Slamikhin near the Bolshoi Uzen River, 12 Jun 1926, Poyarkova and Poyarkov 38 (AA!); Lake Zharyk-kul, 12 Jul 1928, Nikitin 159, 160, 160a (LE!). AKTOBE: 1 km from the southwestern branch of the Dzhambeit state farm, 10 Jul 1953, Balabaeva s.n. (MW0891014!); valley of the Sagyz River, on the territory of the Beskopa hunting estate (*Aipeisova*, 2013). mugojary: Mugodzhary mountains, Aizassay, 30 Jun 1927, Rusanov s.n. (LE!). EMBA: Uil-Emba interfluvium, Uyl floodplain at the Uilskiy fortification, 11 Jun 1926, Knorring 196 (AA!); basin of the Khobda River, valley of the Bolshaya Khobda River (opposite the village of Taldysaiskiy), 2 Jul 1926, Ilyin and Avramchik 277 (LE!). TURGAY: Naurzum state nature reserve, near Lake Atbakul (north of Ak-Suash), 17 Jul 1939, Levitskiy s.n. (LE!); along the eastern shore of Lake Bai-Nazar-Kopa, 25 Jun 1936, Viktorov s.n. (LE!, MW 891018!); same loc., 23 Jun 1936, Voronov 314 (LE!, MW0891017!); on the road to Kurantal, 5 Jun 1938, Sidorov s.n. (LE!, MW0891019!); 2 km southeast of Lake Dusar-Kul, 21 Jun 1936, Viktorov s.n. (MW0891020!); Kun tract on the left bank of the Irgiz River, 9 Jul 1930, Smirnov 48 (AA!, LE!); Turgai plateau, 40 km west of the village of Irgiz, on the riverine plain of the Irgiz River, 1 Jun 1976, Kamelin s.n. (LE!); 8 km northwest of the village of Irgiz, 2 Jun 1976, Kamelin s.n. (LE!); 5.5 km from the first branch of the Irgiz state farm, bank of the Irgiz River, 31 May 1963, Nukhimovskiy s.n. (MW0891013!); Tersekskiy forest, 25 Jun 1940, Shroter s.n. (LE!, MW0891021!); "Altyn-Dala" State Nature Reserve, valley of the Uly-Zhilanchik River, 1 km west of the village Rakhmet; Lake Sarykopa, coastal strip; basin of the Beleudta River, Dyusenbay in the middle part, 17 Jun 1914, Krashenninnikov 5327 (LE!). WESTERN UPLAND: 45-50 km from N-Dzhezkazgan to the northeast, in the floodplain of the Dzhalanda River (a tributary of the K-Kingir), 9 Jun 1939, Lynchevskiy s.n. (AA!); between Zhairam and Kyzylzhar, south of the village of Chubarkolskiy, lake shore, 27 Jun 1991, Pimenov and Kamelin s.n. (MW0891016!); basin of the Sary-Su river, sources of the Sary-Su river, 29 Jun 1949, (Goloskokov, 1997) (LE!); about the cross of the village of Aktubek, 25 May 2010,

Kupriyanov and Mikhailov s.n. (KG!, KUZ!); valley of the Zhaman-Kon River, 16 May 1997, Mikhailov s.n. (KG!); vicinity of the village of Ainabulak, shore of Lake Shoshkakol, 29 Jun 2013, (Kupriyanov, 2018) (KUZ!); outskirts of the city of Karaganda, valley of the Sokur river, south of the Fedorovsky open-pit mine, behind the dump, 23 Jun 1994, Kupriyanov and Mikhailov s.n. (KG!); vicinity of the shift camp Shubarkol, shore of the reservoir, 80 km along the road, 30 Apr 1989, (Kupriyanov, 2018) (KG!); outskirts of the village of Karabas, 11 Jun 2022, vicinities of the city Karaganda, 2 Jul 2022, Mamyrova s.n. (NUR!); Akmola region, in the valley of the Mukor River (a tributary of the Nura) 20 km south of Akmolinsk, 27 Jun 1932, Polyakov s.n. (MW!); outskirts of the city of Tselinograd, bank of the Ishim River, 4 Jul 1992, Zemlyakova s.n. (KUZ!); vicinities of the city of Temirtau, vicinity of the village of Zhaltyr, water meadow, 13 Jun 2023, Mamyrova (personal observation); vicinity of the village of Karazhar, valley of the Nura River, Astana-Malinovka highway, Korgalzhinsky State Nature Reserve, shore of Lake Esei, roadside hollow, 28 Jun 2022, Mamyrova (personal observation); southern shore of Lake Auliekol, 8 Jul 1955, Zalvf s.n. (MW0891022!). ZAYSAN: East Kazakhstan region, basin of Lake Zaisan, 40 km from the village of Kokpekty, 14 Jun 1972, Pimenov and Boryaev 215 (MW0150077!). BALKHASH-ALAKOL: Ili district, Karoi tract, 1931, Pokrovskaya s.n. (AA!); the northern shore of Lake Sasyk-kol, closer to the northwestern shore, 5 Jul 2005, Ivashchenko s.n. (NUR!). ALTAI: Kalbinskiy ridge [Without detailed locality] (Baitulin and Kotukhov, 2011). TARBAGATAI: Borlu-Akdzhaylyau, 22 Jun 1914, Sapozhnikov and Genina s.n. (LE!) (Fig. 2f).

Notes: Studies have shown that *Rh. altaicum* is found in 13 steppe floristic regions and subregions of Kazakhstan, most of which belong to the northern desert zone besides the exception of findings in the Balkhash-Alakol floristic region. No information was found according to herbarium materials on the occurrence of the species in the territory of the Eastern Upland, Bukeev floristic region, Altai (Orazova, 1966) and Ulutau (Ishmuratova *et al.*, 2016; Kupriyanov, 2020; Mamyrova *et al.*, 2023). According to literary sources, the only location in Altai is in the Kalbinskiy ridge (Baitulin and Kotukhov, 2011). This species was the first to be recorded on the territory of Tarbagatai (Mamyrova, 2023). Soskov (1963) believes that the locus classicus of this species is the steppe of western Baraba.

Sect. *Rhaponticellum* Soscov, Bot. mat. coat of arms. Bot. inst. Academy of Sciences of the USSR, XIX: 400. 1959.

Plants are stemless or with a stem up to 30 cm high, at the base shrouded in dark brown or completely black sheaths of dead leaves, on the inside, mainly in the lower part, densely covered with long silky-white hairs. Involucre leaves are under thin membranous transparent appendages with a brownish spot or border. The corolla is violet-

purple. Tuft is mostly white, detachable, of grooved hard bristles, loosely fused into a ring at the base; the ends of several, larger setae of the pappus are often flattened, widened and randomly lined with hairs: the dorsum of the seta axis is bare; the hairs (barbs) of the seta are equal in size to or less than the width of its axis. Achenes are tetrahedral and ribbed.

*Rhaponticum nitidum* fisch., DC. Prodr. 6: 664. 1837; Soskov, Fl. URSS. 28: 319. 1963; Orazova, Flora Kazakhstanana 9: 372. 1966; Machmedov, Opredelitel' rastenij Srednej Azii, 10: 402. 1993:

- *Rh. caspicum* Fisch. Et Mey., Bull. Soc. Nat. Mosc. XII: 160. 1839
- *Centaurea nitida* B. Fedtsch., Rastitel'n. Turkeстана 757. 1915

Type: KAZAKHSTAN. Caspian Region: In littore orientali maris Caspii, Karelin s.n. (LE01246682!) (Fig. 5).

General distribution: Middle Asia (Kazakhstan, Uzbekistan).

Habitat and ecology: It grows on clayey and sandy steppes, on hillsides, along rocky banks and on dry river beds.

Conservation status: This species is currently not assessed by the national red list assessment.

Phenology: Plants bloom in April–May and bear fruit in June–July.



Fig. 5: Type of *Rhaponticum nitidum*

Specimens examined and literature records: CASPIAN REGION: Meadows along the Sagiz river, 7 Jun 1927, Nikitin 549 (LE!); same loc., 5 Jun 1924, Serova s.n. (LE!); same loc., 8 Jul 1927, Nikitin s.n. (LE!); sands Tuyesu, 8 May 2019, Imanbaeva s.n. (MANG!). AKTOBE: valley of the village of Emba (Aipeisova, 2012). EMBA: Along the estuaries in the Donguztau tract, 12 Jun 1956, Yunatov and Kuznetsov 529 (LE!); same loc., 5 May 2018, Ishmuratova and Kolbaeva s.n. (MANG!); Cretaceous upland Aksuat, Jaman Kanjam tract, 25 Jul 1963, Cherkasov 579 (LE!); left bank of the Emba River, 23 Jul 1963, Cherkasov s.n. (MW0891007!). TURGAY: 32 km south-southeast of the village of Turgay on the Turgay River, eastern cliff of the Turgay plateau, 17 Jun 1976, Kamelin s.n. (LE!); sands of the Sazymbay tract, 16 Jun 1976, Kamelin 6305 (LE!); same loc., 16 Jun 1976, Kamelin s.n. (LE!); Espesai ravine, on the coastal slopes of the ravine, 1913, Spiridonow 6276 (LE!); east of Lake Chelkar-Tengiz, near the Tegene ravine, 27 Jun 1914, Tripolitova s.n. (LE!); near the Beleudy River, above the Dyusenbai River, 12 Jun 1914, Krascheninnikov 319 (LE!); (Bozytken-Nura, 1898), Kryukov s.n. (MW0891006!). WESTERN UPLAND: Along the right bank of the Sary-su River, against the hill Azh-Kanat, 1914, Spiridonow 1088 (LE!); Kara-Dzhir tract, at the confluence of the Sarysu and Kara-Kengir rivers, 11 Jul 1914, Semenov s.n. (TK!). ZAYSAN: Vicinity of the village of Ordynka, 20 Jun 1914, Shishkin 5284 (LE!, TK!); between the sandy cape on Lake Zaisan and Mount Tologa, 22 Jun 1914, Shishkin s.n. (LE!, TK!); Topolevyj mys, clayey desert, 16 Jun 1925, Plotnikov s.n. (LE!); between the Kyzyl-Kain and Cousteau rivers, in the foothills of Monrak, 29 Jun 1928, Krylov and Sergievskaya s.n. (TK); Keinkerish clays, 9 Jun 1998, Baikov s.n. (AA!, KUZ!); Mount Shekelmes, rocky slope, 14 May 2001; same loc., 10 May 2001, Kupriyanov (KUZ); Mount Ashutas, 13 Jun 1998, Kotukhov s.n. (KUZ!). NORTHERN USTYURT: Ustyurt plateau, northwestern part, 220 km southwest of the Chelkar railway station, 29 May 1976, Kalibernova 481 (LE!); between the emba river and Usturt, slopes of the Usturt cliff near Ashche-Airyk, 19 Jun 1926, Rozhevits 549 (LE!, AA!); Mount Aktau, 12 Jun 1926, Rozhevits 834 (LE!); Irgiz-by-say ravine, 13 May 1926, Rusanov 330 (LE!); same loc., 13 May 1926, Spiridonov 83 (LE!); eastern slope of the Usturt plateau, 17 May 1914, Dessiatoff s.n. (LE!); the middle part of the Ashik-Taynak, along the bottom of the ridge, 22 Jun 1987, Abenov s.n. (AA!); 35 km northwest of the village Sam-1, 18 Jun 1987, Kudabaeva s.n. (AA!); western cliff of the Ustyurt plateau, Aksai tract, 95 km southwest of the Beineu railway station, 25 May 1982, Safronova 619 (LE!); Western Chink, 14 May 1904, Dubyansky 411 (LE!). ARAL REGION: desertum Aralense, Regio fluv, Ssyr-Darja, 29 May 1857.

Borszczow 419 (LE!); Northern Aral Sea region, northeast of Toguz station, 20 May 1957, Lushpa s.n. (AA!); along the shore of Perovsky Bay in the middle of the valley between the coastal hills going from Alisma and the beginning of the Kutubai tract, 1 Aug 1921, Raikova s.n. (TASH!); Paskevich Bay, 3 Jul 1927, Sergeev 5163 (LE!); 4 km east of Saksaulskaya station, off the eastern shore of the Aral Sea, 31 May 1965, Soskov and Duskabulov (LE!); Ad littoral locus Aral, Kuk-ternak, 15 May 1900, Berg s.n. (LE!, TK!); steep slope of the Aral Sea coast near the village of Ake-spe, 8 May 1930, Gozhev s.n. (LE!); Barsa-Kelmes island on the Aral Sea, 1 Aug 1921, Raikova s.n. (MW0891004!); Northern shore of the Aral Sea, valley of the Turangaly river, 7 May 1914, Dessiatoff 513 (LE!); Jilandy river, 4 Aug 1927, Voleyko s.n. (LE!). Kyzylorda: Syr-Darya region, near village No.7, 5 May 1911, Nikolsky 149 (LE!); outskirts of the city of Kzyl-Orda, 19 May 1958, Kolopov s.n. (LE!); northern edge of the Kyzyl-Kum sands in the area of the Zhana-Daria dry river, 4 Jul 1956, Yunatov and Kuznetsov (LE!); steppe ravine among the ridges behind the Bel-Kuduk well in the direction to the sands of Arys-kum, 13 Jun 1929, Lipshits s.n. (LE!, MW0891005!). BETPAK-DALA: Western coast of Lake Balkhash, near the village of Myn-Aral, 7 Jun 1949, (LE!, AA!); lower reaches of the Sary-su River, chink at the first cape, 1 Jun 1929, Korovin s.n. (LE!, TASH!); left steep high bank of the Syr Darya River 4 km upstream from the Dyurmen-Tyube station, 10 Sep 1942, (AA!); Kogashik tract, 25 May 1940, Rubtsov s.n. (AA!); coast of Bertys Bay, 5 Jun 1935, Rubtsov s.n.(AA!); vicinity of the Uvanas well, 11 Aug 1946, Kubanskaya s.n. (MW!); Kenderlyk, 27 May 1936, Mironov and Pazyi s.n. (TASH!). The Sarysu River in its lower reaches, the vicinity of the Ir tract, cliffs of the left bank of the Sarysu River, 26 May 1914, Krascheninnikov 250/22 (LE!) (Fig. 2e).

Notes. Growth of *Rh. nitidum* on the territory of the Aktobe, Kokchetav and Western Upland floristic regions (Orazova, 1966; Kupriyanov, 2020) is not confirmed by herbarium material; according to the literature, there should be one locality in the Aktobe region (Aipeisova, 2012). Regarding the growth of this species on the territory of the Western Upland, clarification of its distribution in this floristic region is required. In addition to the Flora of Kazakhstan, *Rh. nitidum* is found in Northern Usturt in accordance with herbarium materials.

*Rhaponticum aulieatense* Iljin, Acta Inst. Bot. Acad. Sci. URSS. Ser.1, 1: 205. 1933; Soskov, Fl. URSS. 28: 320. 1963; Orazova, Flora Kazakhstana 9: 372. 1966; Machmedov, Opredelitel' rastenij Srednej Azii, 10: 402. 1993.

Type: KYRGYZSTAN. Kyrgyz Alatau: Syr-Darya region. Aulie-Ata district. Ichkele-tau ridge, Ulkun-Kapka gorge, rocks, 16 May 1909, Minkvits 111 (LE01246686!) (Fig. 6).





**Fig. 6:** Type of *Rhaponticum aulieatense*

General distribution: Middle Asia: Tien Shan. Habitat and ecology: It grows on rocky mountain slopes.

Conservation status: It is included in the Red Book of Kazakhstan (as Category II). There is insufficient information about the state of the population within Kazakhstan. It is important to conduct special studies of the numbers and areas of species populations. Phenology: Plants bloom in May-June and bear fruit in June.

Specimens examined, observations and literature records: KYRGYZ ALATAU: Alexander Ridge, opposite Uch-Bulak, 7 Jul 1924, Popov and Mokeeva 304 (LE!, MW0890972!). KARATAU: Upper reaches of the Elekty gorge, near Lake Billik, 13 Jul 1957, (Soskov, 1963) (TASH!); tract Kara-bas-tau, 30 May 1956, Vvedensky and Kovalevskaya (TASH!); Karatau, southern part, Mount Ak-Murun, 20 May 1934, Chilikina and Volkova (TASH!); Asa River basin, Ak Tau near the Tamdy River, 16 Jun 1925, Abolin s.n. (TASH!); Dzhusaly tract, 19 Jun 1937, Mikeshin s.n. (LE!); near the village of Leontyevka, 11 Jun 1934, Chilikina 303 (MW0890960!); Mount Koktau, 18 Jun 1935, Chilikina 43 (MW0890966!); Kuyuk Mountains, slopes of the Bota-kara river gorge, 5 Jun 1936, Chilikina 288 (LE!, MW0890969); peak of the eastern part of the Kara-tau ridge, Arbatas River, 12 Jun 1936, Chilikina s.n. (LE!, MW0890962!); Big Aktau ridge, 31 May 1936, Chilikina 208 (MW0890961!); ridge against the Kumysta River, 18 May 1985, Pimenov and Melibaev 41 (MW0890964!); Tamdy gorge near Mount Karatau, Ulken-Aktau ridge, 14 Aug 1982, Pimenov 118 (MW0890965!); in the crevices of rocks at the top of Mount Bukut Tau, 28 Jun 1931, Pavlov 390 (MW0890963!); Kenchektau, 7 Sep 2002, Ivashchenko s.n. (NUR!); Sayasu, 4 Sep 2002, Ivashchenko s.n. (NUR!) (Fig. 2a).

Notes: The species is close to *Rh. karatavicum*, but differs from it in having green, almost bare leaves (excluding *f. incanum* Iljin), larger sizes of the stem and basket, non-curly edge of the leaf and the absence of cartilaginous denticles on it. Also noteworthy is the gray shape of *f. incanum* Iljin in the herb. The gray form is found on limestone outcrops; and differs from the typical form in a number of xeromorphic features: Pressed gray felt pubescence of the leaves and stem, greater depth of segmentation of the leaf blade and narrower, lanceolate-ovate lobes (Soskov, 1963).

*Rhaponticum karatavicum* Regel et Schmalh., AHP. 6, 2: 320. 1880; Soskov Fl. URSS, 28: 321. 1963; Orazova, Flora of Kazakhstan, 9: 373, tab.41, fig.4. 1966; Machmedov, Opredelitel' rastenij Srednej Azii, 10: 401. 1993 (Figs. 7a-c):

- *Centaurea karatavica* B.Fedtsch. Rastitel'n. Turkestana.: 757. 1915

Type: KAZAKHSTAN: Karakus, 4000-5000, 30 May 1876, Regel 188 (LE01246683!) (Figs. 7 b-d).

General distribution: Middle Asia: Kazakhstan. Habitat and ecology: It grows on gravelly slopes of mountains at an altitude of 1200-1500 m above sea level.

Conservation status: It has an environmental status and is listed in the Red Book of Kazakhstan as a category II. It is protected in the Karatau State Nature Reserve. There is insufficient information about its population status within Kazakhstan and special research is needed.

Phenology: Plants bloom in June and bear fruit in June-July.



**Fig. 7:** *Rhaponticum karatavicum*: General view (A); type (B); blooming inflorescence (anthode) (C); herbarium type label (D). Photos (A and C): AL Ebel

Specimens examined and literature records: KARATAU: Gravelly slope of the Akku subplateau, 25 May 1930, Lipschitz 331 (MW0890991!); from the Kzyl-Bulak gorge to the west 1 km, 1934, Tekutyev 116 (MW0890992!); Bolau-Degres tract, 17 Jun 1935, Khlebnikova 428 (MW0890993!); Mendzhilke tract, 6 Jul 1935, Khlebnikova 524 (MW0890995!); same loc., 5 Jul 1924, Mokeeva 931 (MW0890990); same loc., 18 Aug 1982, Pimenov 161 (MW0890980!); 1st mountain range of Myndzhilki from Kyzyl ravine, slope of southern exposure, 1 Aug 1952, Parfentyeva s.n. (MW0890985!); on the road from Min-Dzhilke to Boyaldir ravine, 5 Aug 1923, Mokeeva s.n. (TASH!); Mount Dolaman-Terek. 19 Aug 1930, same loc., 27 Aug 1930, Mount Ak-Kuz, site No. 11, 10 Aug 1930, Gomolitsky s.n. (TASH!); left tributary of the Boyaldir River, slope of eastern exposure, 15 Jun 1982, Samoilova s.n. (AA!); northeast of Bish-Soz, 5 Aug 1923, Simonov s.n. (TASH!); Almalysay Gorge, 25 May 2001, Veselova s.n. (NUR!); Kazanbulak tract, rocky slopes, 25 Apr 2013, Kupriyanov and Manakov KAZ 07333 (KUZ!); vicinity of the village of Ashchysay (Marusin Klyuch), rocky slopes, 18 May 2014, Kupriyanov KAZ 05285 (KUZ!); along the cracks of the rocks under the top of the table mountain at the beginning of the Turlan Gorge, 4 Jun 1948, Pavlov s.n. (MW0890986!); the rocky northeastern slope of Agalak-sai, 7 Jun 1936; rocky northwestern slope, Kondenep-sai tract, 29 May 1934; same loc., 8 Jun 1934, rocky northeastern slope of the Uristat tract, 26 Jun 1935, same loc., 10 Jul 1934; rocky north-eastern slope, Kara-say tract, 23 May 1934, rocky northwestern slope of the Su-alma tract, 23 Jun 1934, rocky-gravelly say, Uch-Kez tract, 22 Jun 1934, Pyataeva s.n. (TASH!); Itmuryr River gorge, rocky slope, north-eastern exposure, 12 Jun 1982, Zhanarova s.n. (AA!); Balakchi tract, rocky peaks above the Ak-say gorge, 5 Jun 1930, Lipschitz 407 (MW 0890987!, MW 0890988!); Near River Uzen, 11 May 1939, Pavlov 257 (AA!, MW0890984) (Fig. 2c).

*Rhaponticum namanganicum* Iljin, Acta Inst. Bot. Acad. Sci. URSS. Ser.1, 1: 206. 1933; Soskov, in Fl. URSS. 28: 321. 1963; Nikit., Fl. Kirgizskoi SSR. 11: 385. 1965; Machmedov, Opredelitel' rastenij Srednej Azii, 10: 402. 1993.

Type: UZBEKISTAN. Chatkal ridge: The slope to the Chukur-Sai River is 2 km south-southeast of Lake Gava. Rocky steppe in the juniper forest zone, 16 Jul 1931, Knorring 167 (LE01261174!) (Fig. 8).

General distribution: Middle Asia: Tien Shan.

Habitat and ecology: It grows on gravelly slopes in the juniper belt, on variegated flowers at an altitude of over 2000 m above sea level.

Conservation status: This species is currently not assessed by the national red list assessment. We consider it necessary to include *Rh. namanganicum* into the next edition of the Red Book of Kazakhstan.

Phenology: Plants bloom in July and bear fruit in August.

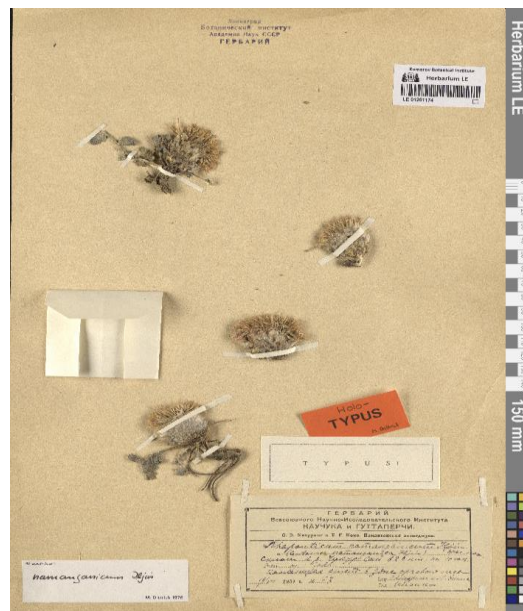


Fig. 8: Type of *Rhaponticum namanganicum*

Specimens examined, observations and literature records: WESTERN TIEN SHAN: Western Tien Shan, Aksu-Dzhabagly Nature Reserve, left bank of the Aksu River, above the Hydrometeorological Station (HMS) Chuuldak, Kensai level, 2300 m, fine gravel gentle slopes, 16 Jun 1988, Ivashchenko s.n. (AA!); Ugam ridge, northern exposure at the crest of the slope, left bank of the Ugam River, damp fine-crushed screen, 2 Jul 1997, (by personal observation) (Fig. 2d).

Notes: The species is very close to *Rh. nanum* but is clearly distinguished by solid leaf segments, the absence of violet-purple coloring of the ends of the inner leaflets of the involucre and their uncolored appendages (Soskov 1963). The species was first listed for the Flora of Kazakhstan (Ivashchenko, 1997). There is insufficient information about the population status within Kazakhstan. Special field research is required. According to other authors, these species grow on the southern side of the Chatkal Range in the middle part of the slopes, within rare juniper forests (Sennikov and Lazkov, 2013). It can also be found on the northern side of the Chatkal range and in the Pskem range (Lazkov and Umralina, 2015).

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## Author's Contributions

**Saule Alikhankyzy Mamyrova:** Conceptualisation, methodology, written preparation of the initial draft, author's supervision.

**Andrey Nikolayevich Kupriyanov:** Conceptualisation, preparation of the initial draft, edited.

**Anna Andreevna Ivashchenko:** Preparation of the initial draft, edited.

**Serik Argyzbekovich Kubentayev:** Methodology, formal analysis, edited, author's supervision, acquisition of funding.

## Ethics

This article is original and contains unpublished material. The corresponding author confirms that all coauthors have read and approved the manuscript and that no ethical issues are involved.

## Declaration of Competing Interest

All authors declare that they have no competing interests and personal relationships and agree on the contents of the paper.

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