

A synopsis of the genus *Rheum* (*Polygonaceae*) in Iran with description of three new species

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Abstract

According to previous studies, the genus *Rheum* in Iran includes four species: *R. turkestanicum* Janisch., *R. persicum* Losinsk., *R. ribes* L. and *R. khorasanicum* Baradaran & Jafari. During the long-term study, based on field and many herbaria specimens, three new species including *R. iranshahrii* Taheri & Assadi sp. nov., *R. kordestanicum* Taheri & Assadi sp. nov. and *R. austro-iranicum* Taheri & Assadi sp. nov. were discovered in Iran. In this paper, all new species are compared with their putative relatives. Botanical characters are elaborated and a brief taxonomic synopsis for all accepted species is also provided.

Keywords: Flora of Iran, Rhubarb, taxonomy

Introduction

The Rhubarb (*Rheum*, *Polygonaceae*), a highly diversified genus, is composed of about 60 species worldwide, most of which are distributed in the Qinghai-Tibetan Plateau, Asia and Europe (Kao & Cheng 1975, Wang *et al.* 2005, Sun *et al.* 2012). For thousands of years, Rhubarb has been used in the world for early spring vegetable and medicinal purposes (Rumpunen & Henriksen 1999). The roots of Rhubarb species have been widely used as a purgative and anti-inflammatory agent (Yang 1991). Moreover, the species grow rapidly and establish a big canopy on top of soil, protect it against water and wind erosion.

In relation to environmental pressure and habitat change, morphological features of this genus show great variability. The ecological diversity and habitat isolation may have provoked rapid speciation of *Rheum* in small isolation populations by nucleotide substitutions, polyploidization or hybridization (Wang *et al.* 2005, Sun *et al.* 2012).

Some botanists have previously studied the genus *Rheum* in Iran, e.g. Rechinger & Schiman-Czeika (1968) in Flora Iranica. They reported nine species for the Flora Iranica area, three of these introduced in Iran. Jafari *et al.* (2012) introduced *R. khorasanicum* Baradaran & Jafari as a new species from Binalood mountain, and noted that pyramidal inflorescence have specially cordate-ovoid bracts in this species.

In this paper, we review the genus *Rheum* in Iran, report new records and ecological information for the species, characterize morphological variation among *R. ribes* L. and its putative close relatives, and provide a brief taxonomic synopsis for the species.

Materials and Methods

We extensively studied the distribution of *Rheum* species in Iran. This study was mainly based on plant materials deposited in TARI (Research Institute of Forests and Rangelands Herbarium) and FUMH (Ferdowsi University of Mashhad Herbarium), IAUM (Islamic Azad University, Mashhad Branch), Iranian Research Institute of Plant Protection (IRAN) and some new collections from the field. Measurement of floral organs, fruits and vegetative characters were done under a stereomicroscope (Olympus BX-53). Identification of the specimens was performed using regional floras such as Flora Iranica (Rechinger & Schiman-Czeika 1968), Flora of Turkey (Cullen 1985), Flora of Pakistan (Qaisar 2001) and Flora of the USSR (Komarov 1936).

Results and Discussion

Observation of present study indicated that the following characters have informative taxonomic value: type of the leaf indumentums, shape of inflorescence, length of pedicles, place of pedicle's joint, perianth length, fruit arrangements, fruit shapes and fruit wing width/achene width.

Seven species of the genus *Rheum* with different botanical and ecological sites are recognized from Iran. Prior to this study four species of *Rheum* named *R. ribes*, *R. turkestanicum* Janisch., *R. persicum* Losinsk. and *R. khorasanicum* were known from Iran (Rechinger & Schiman-Czeika 1968, Jafari *et al.* 2012). Supplementary studies on herbarium specimens and living plants in the field using available data showed that, there are three undescribed species from Iran. In this paper, the new species are described, and a new identification key of the genus *Rheum* is provided.

Rheum kordestanicum Taheri & Assadi, sp. nov.
(Figs 1 & 2)

Type: Kordestan prov., 50 km from Baneh to Marivan, 1650 m, 3 August 1978, *Runemark & Mozaffarian* 29325 (Holotype TARI).

- Diagnosis

Rheum kordestanicum is related to *R. ribes*. It may be confused with *R. ribes* by having rough stem, rough and short petiole, reniform and rough leaf blades on both surfaces and fruits are in fascicles. It may be differentiated from *R. ribes* by having very lax and non-fasciculate branches, all branches located in 1/3 upper part of stem, fruits cordate at both ends, perianth segments narrow and relatively long, up to 6 mm long and 2.2 mm broad. Whereas in *R. ribes* branches are in clusters, numbers of branches are more than *R. kordestanicum* and all of them are in clusters. Fruits are cordate at base and narrowed at summit. Perianth segments are much shorter, up to 3 mm long and 1.5 mm width.

Perennial herb, rhizomes and roots stout, stem up to 80 cm tall, leafless and scapose, reddish-green, erect or flexuous, rough with warts. Leaves radical, ca. 30–55 × 25–35 cm, reniform to cordate, broader than long, with 3 principal veins, the lateral veins marginal up to the first ramification, verrucose on both surfaces, in lower part spinulose on the veins, margin ± undulate. Petioles less than half the length of the blade. Inflorescence broadly pyramidal, bearing non-clustered branches in 1/3 upper part of stem. Flowers fasciculate; pedicels 8–12 mm long, jointed at or below the middle; perianth segments 6 in 2 whorls, ca. 6 mm long, 2.2 mm broad, the inner narrower, persistent in fruit; stamens 9; fruit ovate, up to 18 mm long, 16 mm broad, cordate at both ends; wings reddish, 3.5–5 mm, as broad as the achene; nerve marginal; achene ovate.

Distribution: *Rheum kordestanicum* is an endemic species which based on present knowledge is only known from western parts of Iran.

- Other specimens examined: E Azerbaijan prov., Tabriz to Marand, ca. 7 km to Marand, Mishu-Dagh mountain, NE slope, 1740–2070 m, 24 July 2005, *Azadi & Nikchehreh* 75623 (TARI); W Azerbaijan prov., Urmieh, Soluk, 2400 m, 17 May 1972, *Sabeti*, 7799 (TARI); Urmieh, Sera, 36 km of Urmieh, 1600 m, 14 June 1971, *Iranshahr* 33710 (IRAN); Kordestan prov., Palangan Roo, 2100 m, 8 June 2004, *Iranshahr & Term'e* 33711

(IRAN); Kermanshah prov., between Kermanshah & Paveh, before Shamshir, Mansur Aghai village, Kuh-e Shahu, 1700–2300 m, 12 June 2005, *Assadi & Mehregan* 89247 (TARI); Zanjan prov., Zanjan to Manjil, Tashvir, 800–2200 m, 29 May 1974, *Term'e & Moussavi* 33709 (IRAN).

Rheum austro-iranicum Taheri & Assadi, sp. nov. (Figs 1 & 3)

Type: Hormozgan prov., Bashagerd, 6 km from Jakdan to Senderk (EQ4), 750 m, 5 August 1982, *Mozaffarian, Banihashemi & Shahinzadeh* 39409 (Holotype TARI).

- Diagnosis

Rheum austro-iranicum is related to *R. wittrockii* Lundstr. and it may be confused with it by having leafy, glabrous and smooth stem, small stem leaves or being leafless and a loose spreading inflorescence. It may be differentiated from *R. wittrockii* by having suborbicular leaf blade, with 3 principal veins, shorter petioles in basal leaves, flowers are nearly lax and non-fasciculate, fruits cordate, wings are broader than the achene and deeply cordate at base. Whereas in *R. wittrockii* leaf blades are oval-triangular, with 5 straight principal veins, petioles of basal leaves are relatively long, flowers are densely arranged and fruits are round, fruit wings are as broad as achene and cordate at both ends.

Perennial herb; stem leafy, up to 80 cm long, with non-fasciculate branches at the base, fascicled above, sulcate, reddish-green, erect, smooth. Basal leaves ca. 30–50 × 25–35 cm, suborbicular, broader than long, with 3 principal veins, the lateral veins marginal, up to the first ramification, verrucose on both surfaces, undulate at the margin; petiole less than half the length of the blade; stem leaves smaller, ovate, acute. Inflorescence pyramidal, paniculate, pedicels 7–10 mm long, jointed at or below the middle. Perianth segments 6 in 2 whorls, ca. 3 mm long, 1.2 mm broad, persistent in fruit; the inner narrower; stamens 9; fruit ovate, deeply cordate at base, ± 17 mm long, 14 mm broad, wings reddish, 4–5 mm, broader than the achene, the nerve marginal; achene ovate.

Distribution: *Rheum austro-iranicum* is an endemic species which based on present knowledge is only known from southern parts of Iran.

- Other specimen examined: Hormozgan prov., ca. 50 km NE of Senderk, Araghin (EQ3), 1000–1600 m, 5 May 1982, *Mozaffarian* 44564 (TARI).

Rheum iranshahrii Taheri & Assadi, sp. nov. (Figs 1 & 4)

Type: Semnan prov., Turan protected area, 10 km from Talkhab to Garmab, 1400 m, 5 August 1978, *Freitag & Jadidi* 29041 (Holotype TARI).

Rheum iranshahrii is related to *R. ribes*. It may be confused with *R. ribes* by having subspherical inflorescence, rough stem, rough and short petiole, and rough leaves on both surfaces. It may be differentiated from *R. ribes* by having short flowering stems, solitary or 2–3 flowers on the inflorescence. Pedicels are longer and up to 14 mm long. Fruits are relatively shorter and wings of fruit near the top are nearly as long as achene.

Perennial herbs; stem 20–35 cm tall, sulcate, reddish-green, ± erect, leafless, rough with warts. Leaves ca. 30–45 × 20–28 cm, suborbicular, broader than long, verrucose on both surfaces, in lower part spinulose on the veins, ± undulate at the margin, with 3 principal veins; the lateral veins marginal up to the first ramification. Petiole less than half the length of the blade. Inflorescence with whorled branches especially at the base, sub spherical; flowers paniculate or in clusters with 2–3 flowers. Pedicels 12–14 mm long, jointed at the middle; perianth segments 6 in 2 whorls, ca. 3 mm long, 1.8 mm broad, the inner narrower, persistent in fruit; stamens 9; fruit ovate, up to 14 mm long, 11 mm broad, cordate at base, narrowed toward summit; wings reddish, almost narrow, 2–3.5 mm, as broad as the achene; the nerve marginal; achene ovate.

- Etymology: The new species named after Dr. M. Iranshahr, the retired plant taxonomist in IRAN herbarium.

- Other specimens examined: Khorassan prov., Ferdows, Abgarm, 1400 m, 4 May 1992, *Delghandi, Karavar & Tehrani* 33708 (IRAN); Ferdows, Abgarm, 1500 m, 4

May 1999, *Hojjat & Zangoee* 32284 (FUMH); 20 km on road from Birjand to Qaen, 18 May 1986, *Ayatollahi & Zangoee* 14314 (FUMH); Birjand, Sarchah, Mazar-e Shah Soleyman Ali, 1900 m, 26 April 1998, *Faghihnia & Zangoee* 30081 (FUMH); Birjand, Behdan, 2100 m,

28 April 1998, *Faghihnia & Zangoee*, 30150 (FUMH); Birjand, Aminabad, 1900 m, 2 May 1998, *Faghihnia & Zangoee* 30341 (FUMH); Gonabad, Senou, Darreh-Nakhou, 1600 m, 25 April 1991, *Faghihnia & Zangoee* 19602 (FUMH).

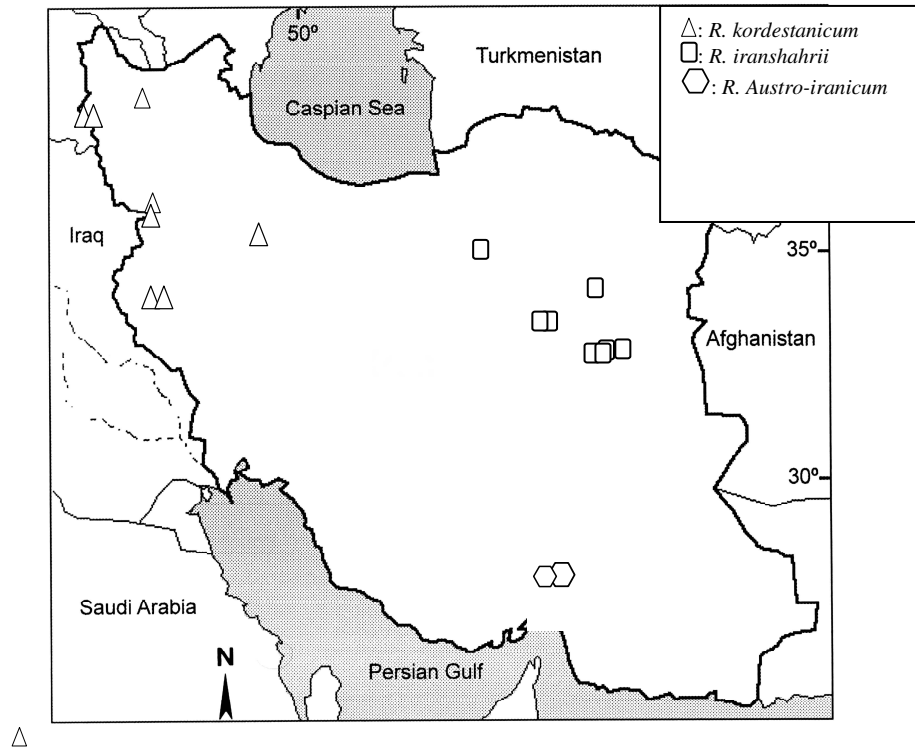


Fig. 1. Distribution map of new records of *Rheum* from Iran.

Key to the *Rheum* species in Iran

1. Stem leafy 2
- Stem leafless 3
2. Inflorescence branches fasciculate; fruit wings narrower than achene *R. khorasanicum*
- Inflorescence branches solitary; fruit wings broader than achene *R. austro-iranicum*
3. Herbs small; flowering stem up to 30 cm long. Leaf blades with stellate hairs *R. Persicum*
- Herbs large; flowering stem up to 80 cm long. Leaf blades verrucous, papillose or glabrous but without stellate hair 4
4. Inflorescence branches fasciculate..... 5
- Inflorescence branches solitary 6
5. Flowering stems up to 35 cm long; Flowers paniculate or 2–4 in clusters; pedicels up to 14 cm long *R. iranshahrii*
- Flowering stem up to 100 cm long; Flowers fasciculate, 7–12 in clusters; pedicels up to 10 cm long *R. ribes*
6. Inflorescence spherical, highly branches; pedicels up to 7 mm long; perianth segments 2.5–3 mm; wings of fruits cream or milk-white; nerves about 2 mm from the margin *R. turkestanicum*
- Inflorescence pyramidal, with 3–7 branches; pedicels 8–12 mm long; perianth segments 4.5–6 mm long; wings of fruits reddish; nerves running along the margin *R. kordestanicum*

Table 1. Comparison of morphological characters of seven *Rheum* species in Iran

Characters	<i>R. ribes</i>	<i>R. khorsanicum</i>	<i>R. Iranshahrii</i>	<i>R. turkestanicum</i>	<i>R. persicum</i>	<i>R. austro-iranicum</i>	<i>R. kordestanicum</i>
Stem	leafless	leafy	leafless	leafless	leafless	leafy or leafless	leafless
Branches of inflorescence	fasciculate	fasciculate	fasciculate	non-fasciculate	non-fasciculate	non-fasciculate	non-fasciculate
Shape of inflorescence	sub spherical	pyramidal	sub-spherical to orbicular	sub spherical	pyramidal	pyramidal	broadly pyramidal
Fruit arrangement	fasciculate	fasciculate	non-fasciculate	fasciculate	fasciculate	non-fasciculate	fasciculate
Leaves indumentum	warty, glabrous or simple hairs	upper verrucose, lower glabrous	warty, simple hairs	glabrous above, scabrous below	warty-stellate hairs	warty	warty
Perianth length (mm)	2.5–3	2–2.2	2.5–3	2.5–3	2.5–3	2.8–3	4.5–6
length of pedicels (mm)	7–10	5–9	12–14	5.5–7	6–8	7–10	8–12
Fruit base	cordate	cordate	cordate	cordate	cordate	deeply cordate	cordate
Ratio: width of wings/seed	~1	less than 1	~1	more than 1	~1	more than 1	~1
Wing nerves distance from margin	marginal	marginal	marginal	about 2 mm	marginal	marginal	marginal

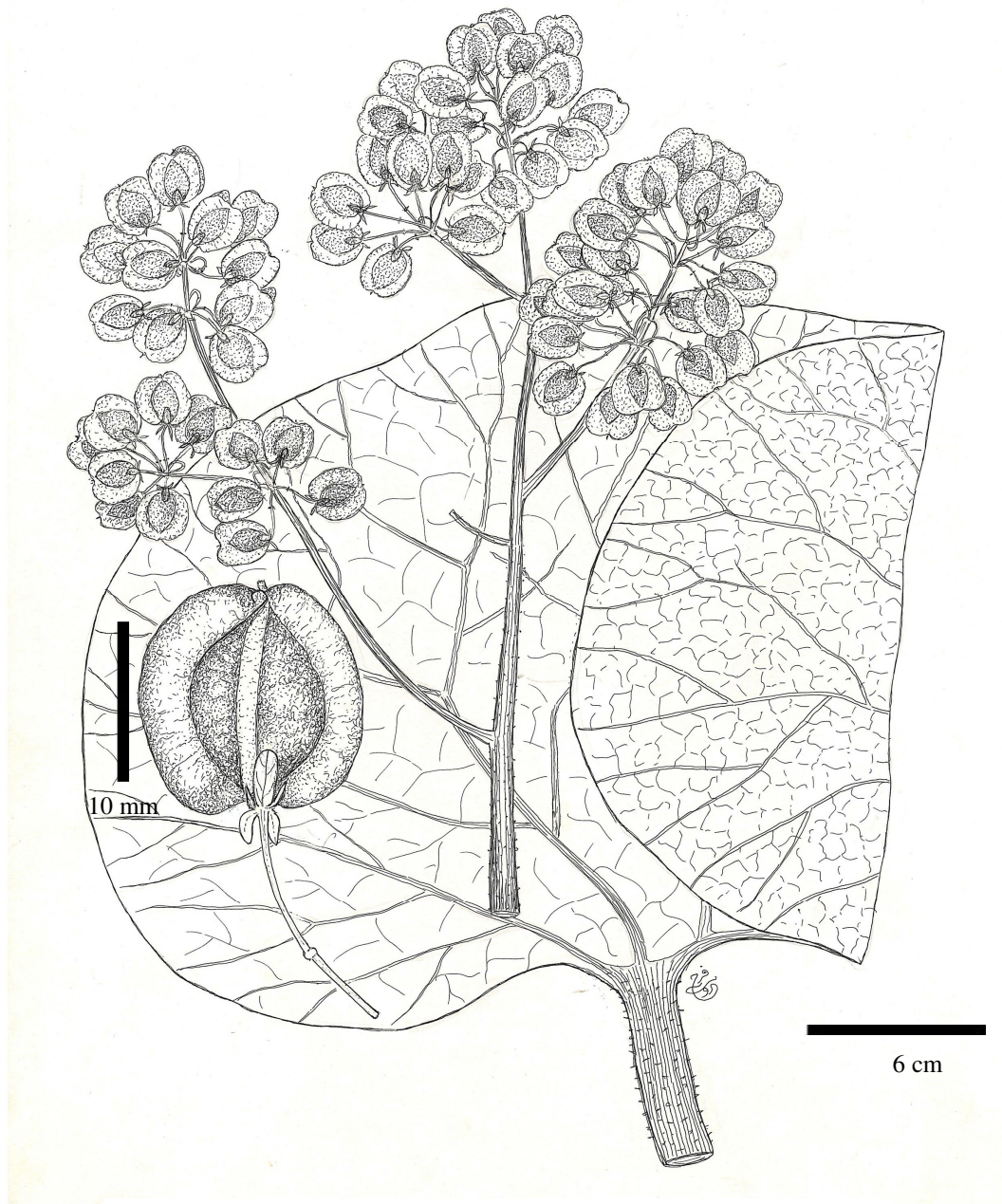


Fig. 2. *Rheum kordestanicum* (Holotype 29325, TARI).

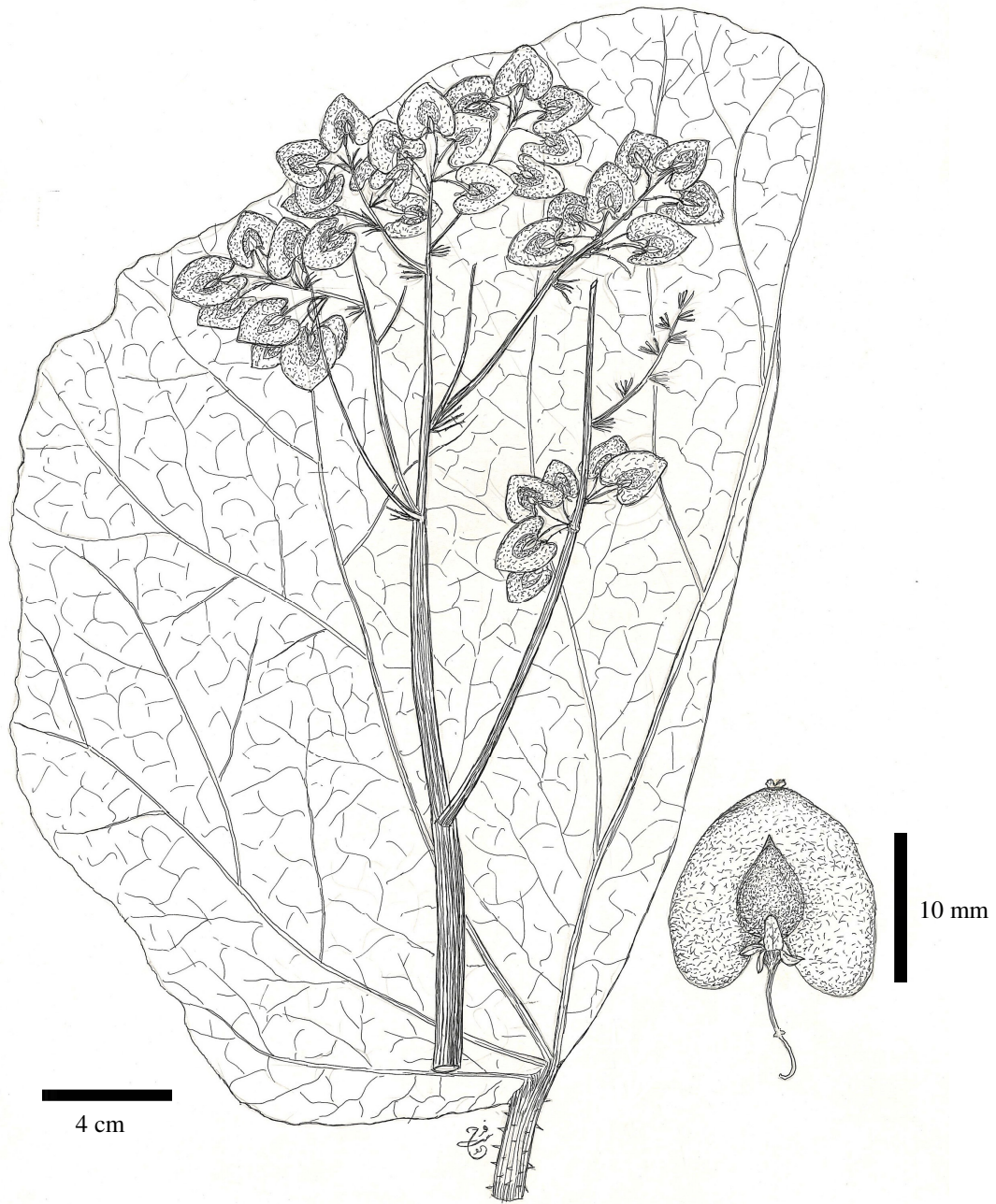


Fig. 3. *Rheum austro-iranicum* (Holotype 39409, TARI).

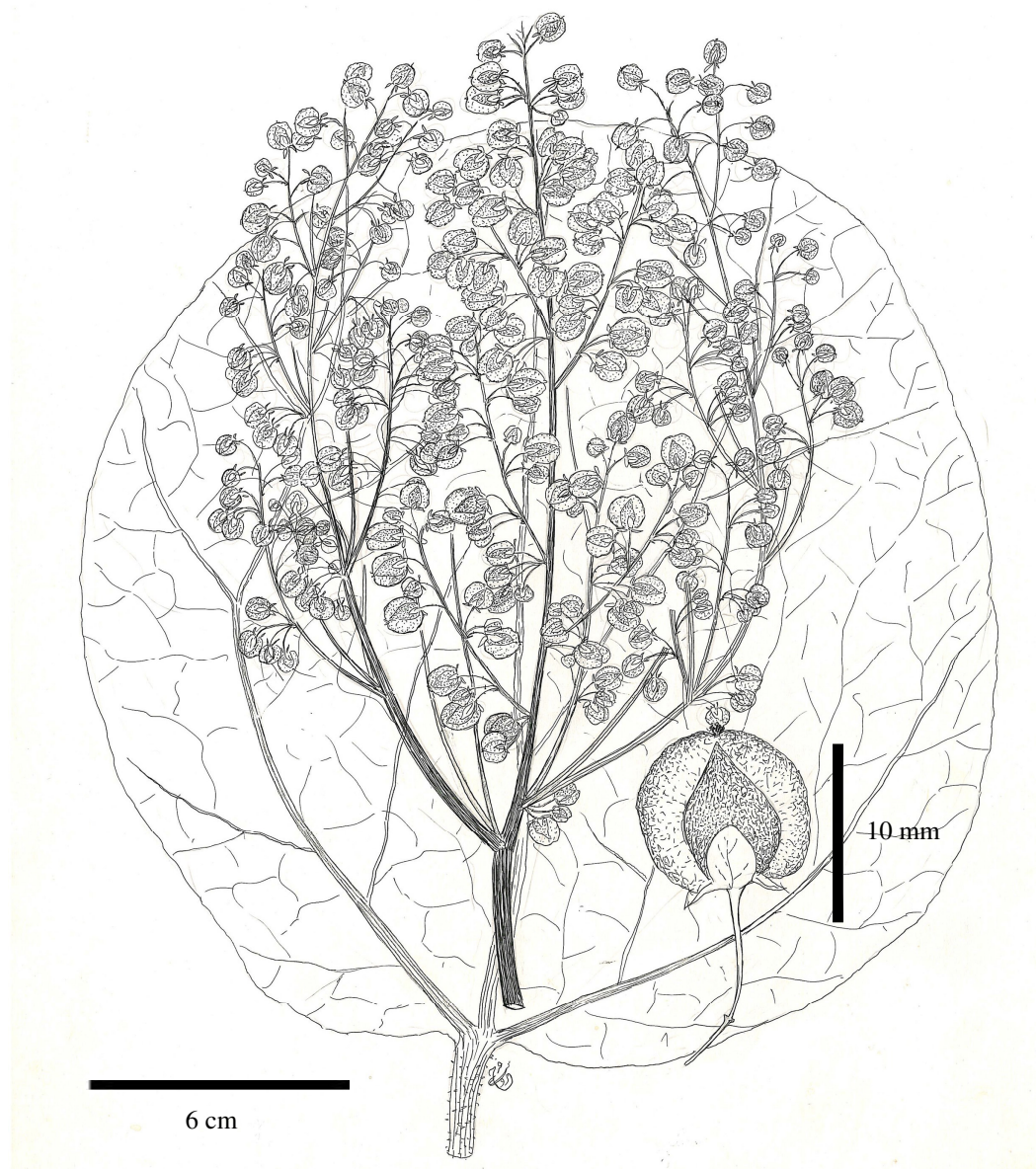


Fig. 4. *Rheum iranshahri* (Holotype 29041, TARI).

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