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Seasons are changing around the world – whether you are in the northern or southern hemisphere we can hope that you are still getting pleasure and comfort from your garden plants. This month's IRG brings new descriptions of three *Puschkinia* species from the Iranian Alborz and Zagros mountains and no less than five new *Crocus* species from north-western and western Iran. Authors are Janis Rukšāns, from Latvia, with Dimitri Zubov, from Ukraine and Janis with Alireza Dolatyari from Iran. Further evidence, if such were needed, of the wealth of plant diversity in Iran.

Cover image: *Crocus chionophilus* - seed capsule and seeds - photo Janis Rukšāns.

Early summer in a Scottish garden.

This image is of the Perthshire garden of the editor of the SRGC printed twice-yearly journal – The Rock Garden. Anton Edwards and his wife, Margaret have made this garden over the last 25 years- it began as a bare field! Back issues of The Rock Garden may be found on www.srgc.net

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--- Species Description ---

Three new and noteworthy *Puschkinia* species (Asparagaceae: Scilloideae) concealed in the Iranian Alborz and Zagros Mountains

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Summary Three new puschkinia species growing wild in N, NW & W Iran are described and illustrated; the differences between new species and other related puschkinias are discussed. The main and important speciation and biodiversity centre for the genus *Puschkinia* has been revealed within the mountainous area to the south & east of between Lake Van (E of Taurus Mountains & SE of Armenian Plateau, E Turkey) and Lake Urmia (NW & W of Zagros Mountains, NW & W Iran). Actually, seven *Puschkinia* species are known within the previously monotypic Western Asian genus, including three new taxa described here from Iran. Photographs, two alternative keys to the species identification and distribution maps are provided.

Key words:

Geophyte, puschkinia, speciation, biodiversity, Armenian Plateau, Zagros mountains, Taurus mountains, Alborz mountains, Avroman mountainous region, Flora Iranica.

Introduction

For a couple of centuries (1805 - 2007), the genus *Puschkinia* Adams remained monotypic. It was named after Russian chemist and mineralogist, the count Apollos Mussin-Puschkin, who was also a member of the Georgian mining expedition in 1800-1803, organised by the Saint Petersburg Academy of Sciences. The genus and its only species, *Puschkinia scilloides* Adams, were described in 1805 by Russian naturalist, zoologist, and botanist Michael (Johann) Friedrich Adams from the southern-sided subalpine meadows of Mount Ararat (the Armenian Plateau) [1]. Actually, it is not possible to trace the *P. scilloides* holotype specimen, but the Armenian botanist Nora Gabrielyan indicates that the type is most likely stored in LE? herbarium [6]. Although in 2003, a Russian botanist Helena Mordak designated a lectotype for *P. scilloides* based on Georgian specimen: "*Mordak, hoc loco: Ex Caucaso iberico.*

Comm. Adams; (LE!)" [13]. In general, *P. scilloides* is distributed from highlands of Turkish SE & E Anatolia through the Near East, Greater & Lesser Caucasus, E Caucasus, Ciscaucasia and Transcaucasia, and up to the Iranian Plateau [5-8, 10, 14, 16, 20].

The first break in the monotypic *Puschkinia* genus was made in 2007, when Martyn Rix and Brian Mathew published a new species of unique greenish-flowered *Puschkinia peshmenii* Rix & B. Mathew described from E Turkey (Provinces of Hakkari: Yüksekova, and Van: Pelli Dağğĭ (Alacabük Dağı) [17]. In 2014, Turkish botanist Hasan Yildirim published a taxon of *Puschkinia bilgineri* Yildirim, also described from E Turkey (Provinces of Van: Karabet Pass - Kavuşşahap (İhtiyarşahap) Dağları, and Hakkari: Yüksekova) [21]; and almost simultaneously, only nine days later, the same species from Karabet Pass was published by J. Rukšāns as *Puschkinia kurdica* Rukšāns [18]. Although publishers of *P. kurdica* made their manuscript two months earlier than publishers of *P. bilgineri*, the naming priority of course belongs to Yildirim's taxon, as published earlier. Nevertheless, in 2019 J. Rukšāns published another species of *Puschkinia kurdistanica* Rukšāns described from south-eastern part of the Armenian Plateau in E Turkey (Van Province: southern shoreside of Lake Van) [19]. Both of these latter ones have a quite restricted area of distribution.
It seems that the hot-spot-area to the south and east from Lake Van to Lake Urmia is an important centre of speciation and biodiversity for the genus *Puschkinia*.

At the same time, the whole distribution area for *P. peshmenii s.l.* remains questionable. Presumably, this taxon was regarded as only distributed within E Turkey in the Provinces of Van and Hakkari; and in the same paper it is noted that John Ingham found it 650 km to the east of the type locality as well (north-western section of Lake Urmia basin and in the Alborz mountains) [17]. Similar plants were discovered in 2004 during BATMAN expedition organized by Henrik Zetterlund (Gothenburg Botanic Garden, Sweden; *pers. comm.*) in E Turkish Bingöl Province, almost 400 km to the north-west from the *locus classicus* of *P. peshmenii*. Also, it should be noted that morphologically similar plants were observed by J. Rukšāns in 2017 and 2022 in W Iran, 250 km to the south-east from the *locus classicus*. Therefore, additional studies are needed to resolve an issue, if these E Turkish and W Iranian puschkinia accessions all belong to *P. peshmenii* or represent a different species. One of the targets of our cancelled 2020 Iranian expedition was a resolution of this taxonomic enigma. But this expedition was only accomplished by J. Rukšāns in April 2022, when he collected the herbarium samples, based on previous known 2017 locality. In 2022, this

Puschkinia sp. was found *in situ* in full bloom, showing side by side two colour forms – pure white and bluish shaded (an accession no. 22IRS-082).

It should also be noted that taxonomic twists and turns regarding *P. scilloides,* originally described from Lesser Caucasus (the Armenian Plateau), are no less confusing. Being distributed within an extremely wide area from E & SE Turkey up to W & N Iran and Lebanon, it is characterized as quite morphologically variable species [5-8, 10, 14, 16, 20]. In 1843, a German botanist Joseph Zuccarini published a second *Puschkinia* taxon from The Mount Lebanon range – *P. libanotica* Zucc., which has larger flowers and more acute corona teeth [22]. In 1871 John Gilbert Baker added the third taxon – *P. hyacinthoides* Baker, basing his description on a longer perianth tube and shallowly incised corona [3]. However, a British botanist John Edmondson in Flora of Turkey and the East Aegean Islands (1984) considered that all these taxa fall within the variability of the only one species – *P. scilloides* [5]. In our living collections, among all grown *P. scilloides* accessions, there are representatives from populations with both deeply divided and acute teeth of corona, as well as with shallowly incised corona. As a rule, plants in separate populations are quite uniform by those morphological features and sometimes they differ between various populations. Just by comparison, *Puschkinia* isn't a single genus with a wide distribution area and significant variability rate between populations, e.g., *Iris reticulata* M. Bieb. is regarded for the moment as a single, extremely variable species, although, by our opinion, under that name several different taxa are hidden, which are noteworthy for prospective taxonomic description.

Puschkinia peshmenii, the Rix form – cultivated.

Puschkinia bilgineri (syn. *P. kurdica*) – in habitat, Karabet Pass, E Turkey.

Puschkinia kurdistanica BATM-060 – cultivated.

Two forms of *Puschkinia* cf. *peshmenii* 22IRS-082 with atypical lax racemes – in habitat, W Iran.

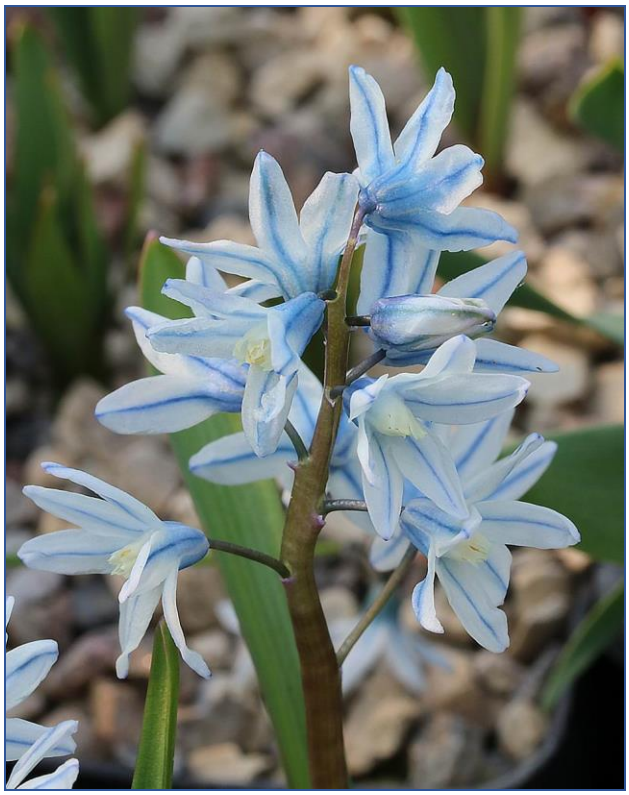
Above, left: A huge raceme of cultivated *Puschkinia scilloides* KPPZ 90-221 is so similar to a hyacinth raceme, that for years it was grown just as *Hyacinthus sp.*

Above right: *Puschkinia scilloides* BATM-148 – in habitat, the south of Tendürek Pass, 2650 m, E Turkey.

A large raceme of *Puschkinia scilloides* WHIR-126 – in habitat, Kuhha-ye Talesh, 2080 m, NW Iran.

Above left: A large raceme of *Puschkinia scilloides* 18IRS-072B – in habitat, Kuhha-ye Sabalan, 2700 m, NW Iran.

Above right: *Puschkinia scilloides* – cultivated, from a vicinity of Mt. Aragats, c. 2500 m, Armenia.



Puschkinia scilloides CMGG-028 – cultivated, from Devdaraki valley, 1700 m, Georgia and right, flower details.

Left:
Puschkinia scilloides – cultivated, from the Zangezur Mts., 2100 m, Armenia.

Below:
A dwarf *Puschkinia* cf. *scilloides* WHIR-151 (possibly, a new species) – Takht-e Soleyman Massif, 2620 m, NW Iran

Map 1: Distribution of the *Puschkinia* species within N, NW & W Iran, based on collection localities: orange marks – *P. avromanica*, yellow marks – *P. parvula*, red mark – *P. latifolia*, and light green marks – *P. scilloides.*

As independent researchers, we have no access to molecular & genetic analysis tools, so it remains for us to check morphological characters, habitat, ecological conditions, breadth of distribution area and, at last, the possibility of interspecific hybridization between different samples/species/races. During our expeditions in Armenia, Georgia, Turkey, Iran we always collected a few samples of *Puschkinia* in different localities (sample accessions). This allowed us to compare various populations in cultivation by growing all accessions side by side under identical conditions and regularly collecting and sowing seeds separately. In such a way we checked how constant the features are from a studied population and how they are stable through generations. Those observations allowed us to separate differently collected puschkinia accessions from poorly studied Iranian localities, which are easily distinguishable from others and keep their specific features through several progenies reproduced via open pollination.

Over time, our living geophyte collections included several *Puschkinia* accessions from N, NW & W Iran (the Alborz and Zagros mountains, Urmia basin), which, according to their unique morphological characters, were easily distinguished from a number of other *Puschkinia* species accessions we grow and which we considered noteworthy to describe here as three new species.

Materials and Methods

Field studies for *P. avromanica* were undertaken in May 2018 and April 2022 in western Iran (Kurdistan Province: the Avroman mountainous region within the central section of the Zagros mountains), and living material in cultivation (Latvia, Ukraine) was examined by us between 2019 and 2022. Field studies for *P. parvula* were undertaken in May 2018 and April 2022 in western Iran (West Azerbaijan Province: south-western & western sections of Lake Urmia basin), and living material in cultivation (Latvia, Ukraine) was examined between 2019 and 2022. Original plants of *P. latifolia* were collected by Dr. Arnis Seisums in May 1998 in northern Iran (Māzandarān and Alborz Provinces border: central section of the Alborz mountain range) and living material (including seed grown progeny) in cultivation (Latvia, Ukraine) was examined between 1999 and 2022. Herbarium specimens of other related puschkinia species were examined at K, RIG and GB herbaria (abbreviations after [9]). Measurements, colours, and other details are based on living material, herbarium specimens and data derived from field notes. Morphological examinations were made using a stereo microscope Stemi 2000-C and inverted microscope AxioObserver A1 equipped with digital camera AxioCamERc 5s and ZEN 2012 software (Carl Zeiss, Germany). Morphological terminology follows [4]. The distribution maps were plotted and produced using specimens and recorded coordinates and verified using Google Earth Pro (©2017 Google). The preliminary conservation status of *P. avromanica, P. latifolia,* and *P. parvula* were not evaluated against the Red List Criteria [11] due to the insufficient data on these three new species full-range distribution. Photos are taken by J. Rukšāns & D. Zubov, and maps were generated by J. Rukšāns.

Taxonomic Treatment and Discussion

The Avroman mountainous region in the Central Zagros

In 2008 during WHIR expedition [WHIR – derived from Jill **Wh**ite (UK), who organized **I**ranian Trip] to W Iran within the Avroman (Hawraman) mountainous region (less commonly known as the Avroman Mountain) located in central section of the Zagros Mountains [12] and during our 2018 Iranian IRS expedition in some distance from the former place (an accession no. 18IRS-026, 2560 m elevation), we observed some scattered micro populations of a dwarf, few-flowered Puschkinia having a short flower stem with only 1-4(-5) flowers between 2(-3) short and narrow, deeply channelled, dark green with indistinctly purple margin leaves (an

accession no. WHIR-185, 2280 m elevation). Its small size could be explained by high altitude growing conditions, if not comparing P. scilloides plants of “normal size” of an accession no. 18IRS-072B from even higher elevation at Kuhha-ye Sabalan ridge (at 2700-2800 m elevation) and an accession no. WHIR-126 from Kuhha-ye Talesh ridge (at 2100 m elevation) both having large, multi-flowered dense cylindrical racemes. The accession no. WHIR-185 plants from Avroman were regularly multiplied in cultivation from seed and despite growing side by side with P. scilloides plants from other localities, it kept its dwarf habitus from seedling generation to generation. Interesting to note that those Avroman puschkinia plants produce few side-directed bulb stolons and reveal bright violet colouration of the leaf bases when herbarised.

Therefore, we decided to describe it as a noteworthy new species – the Avroman puschkinia.

Puschkinia avromanica Rukšāns & Zubov **sp. nov.**

Type: Iran, Kurdistan Province, in rocky outcrops along the road from Kermanshah to Marivan via Paveh, 35°16' N, 46°10' E, at 2563 m elevation; *fl.* 03 May 2018, Rukšāns & Zubov s.n. (holotype GB!, isotype RIG!).

Bulb – 13-18 mm in diam., 20-25 mm long, ±spherical with a pointed apex, covered with previous years’ dark greyish brown tunics, inner tunics greyish white, adventitious roots white, unbranched; often stoloniferous with 1-2 leafless bulbils at the stolon top.

Leaves – 2(-3), supervolute, the inner leaves smaller in size, spaced apart, up to 7-10 cm long and 6-15 mm wide, lanceolate, glabrous, flared upward and canaliculated, glaucescent, dark green with reddish-brown base and reddish-brown thread-like edging, reddish-brown abaxially at early stage, distinctly cuculate at the top with pointed white apex; leaf bases turned bright violet *in exsiccatae*.

Scape – 1, erect, thin, up to 5-8 cm long, purplish shaded dull green, lightens to blurred green to the upper part: *raceme* simple, lax.

Flowers – 1-4(-5), broadly funnel-shaped, 9-16 mm long and 17-20 mm in diam.

Perianth segments – 6, connate at the base to form a tube *c.* 1/2 of a perianth length; *perianth tube c.* 8 mm long; *segment free parts* ±of the same length – 9-10 mm long and 3-4 mm wide, bluish with weak lilac shade, blurred greyish blue on tube abaxially, midrib contrast, blue-lilac; *pedicels* unequal, erecto-patent to patent, lilac brownish, lower – up to 6 mm long, upper – 2-4 mm long; *bracts* obsolete, indistinct, bifid, purplish-white, membranous, irregularly and shallowly dentate.

Androecium – *stamens* 6; the bases of the stamens flattened and closely clustered in the ±middle of a perianth and connate to form a conical, white, 6-lobed *corona c.* 8 mm long; *corona lobes* (alternating with stamens) 1-1.5 mm long, irregularly and shallowly dentate at the top; *filaments* obsolete, white, less 1 mm long; *anthers* epipetalous, adnate adaxially between the very base of corona lobes, subsessile, dorsifixed, versatile, introrse, narrow ovoid, 1.5-2 mm long, straw yellow; *pollen* straw yellow.

Gynoecium (ovary and receptacle) – syncarpous, tricarpellate; *ovary* superior, sessile, rounded, indistinctly 3-ribbed, brownish green, *c.* 3 mm in diam.; placentation axile, ovules numerous per locule; *style* short, erect, *c.* 3 mm long, white, distinctly violet at the lower half; *stigma* small, white, capitate.

Fruit – a membranous, loculicidal *capsule*: 6-10 mm long and 7-11 mm in diam., ±gourd-shaped, slightly 3-ribbed with a little beak at the top, straw green with a purplish base and persistent faded perianth and style.

Seeds – unevenly ovoid to ±rounded, up to 3-5 mm long and 3-4 mm in diam.; *testa* pale golden brown, alveolate, glabrous.

Recognition – morphologically similar to *P. scilloides*, but differs by having often stoloniferous bulbs; few-flowered (1-4(-5) lax raceme; perianth tube *c.* 1/2 of a perianth length; rounded ovary with white style distinctly violet at the lower half; and leaf bases bright violet *in exsiccatae* (*vs* non-stoloniferous bulbs; multi-flowered (>10) dense cylindrical raceme; perianth tube *c.* 1/3 of a perianth length; elongated ovary with pure white style; and leaf bases straw to brownish *in exsiccatae* in *P. scilloides*).

Distribution – Western Asia: Iran, central section of the Zagros Mountains; possibly a local Avroman endemic. (Maps 1 & 2).

Specimens examined – Iran. Kurdistan Province, in rocky outcrops along the road from Kermanshah to Marivan via Paveh, 35°16' N, 46°10' E, at 2563 m elevation; *fl.* 03 May 2018, *Rukšāns & Zubov* s.n. (holotype GB!, isotype RIG!). The exact locality of *P. avromanica* has not been documented here for fear of unlawful plant collecting.

Habitat – on clay-gravel soils among rocky outcrops at high montane meadows, in wet stony slopes near melting snow at 1870-2600 m elevation; within submontane zone vegetation composed of *Prangos uloptera* DC. - *Psathyrostachys fragilis* (Boiss.) Nevski community with scattered shrubs of *Prunus lycioides* (Spach) C.K. Schneid. and subshrubs of thorny *Astragalus mesoleios* Boiss. & Hohen. [2, 15], accompanied by seasonal geophytes and perennials – *Ranunculus* L. sp., *Gagea* Salisb. sp., *Salvia limbata* C.A. Mey., *Ornithogalum luschanii* Stapf, *Fritillaria straussii* Bornm., *F. poluninii* (Rix) Bakhshi Khan. & K.M. Perss., *F. imperialis* L., *F. avromanica* Advay & Teksen, *Corydalis verticillaris* DC., *Colchicum kotschyi*

Boiss., *Bellevalia longistyla* (Miscz.) Grossh., *etc.*; currently known only from the type locality and surrounding sites but could be distributed wider within Central Zagros area.

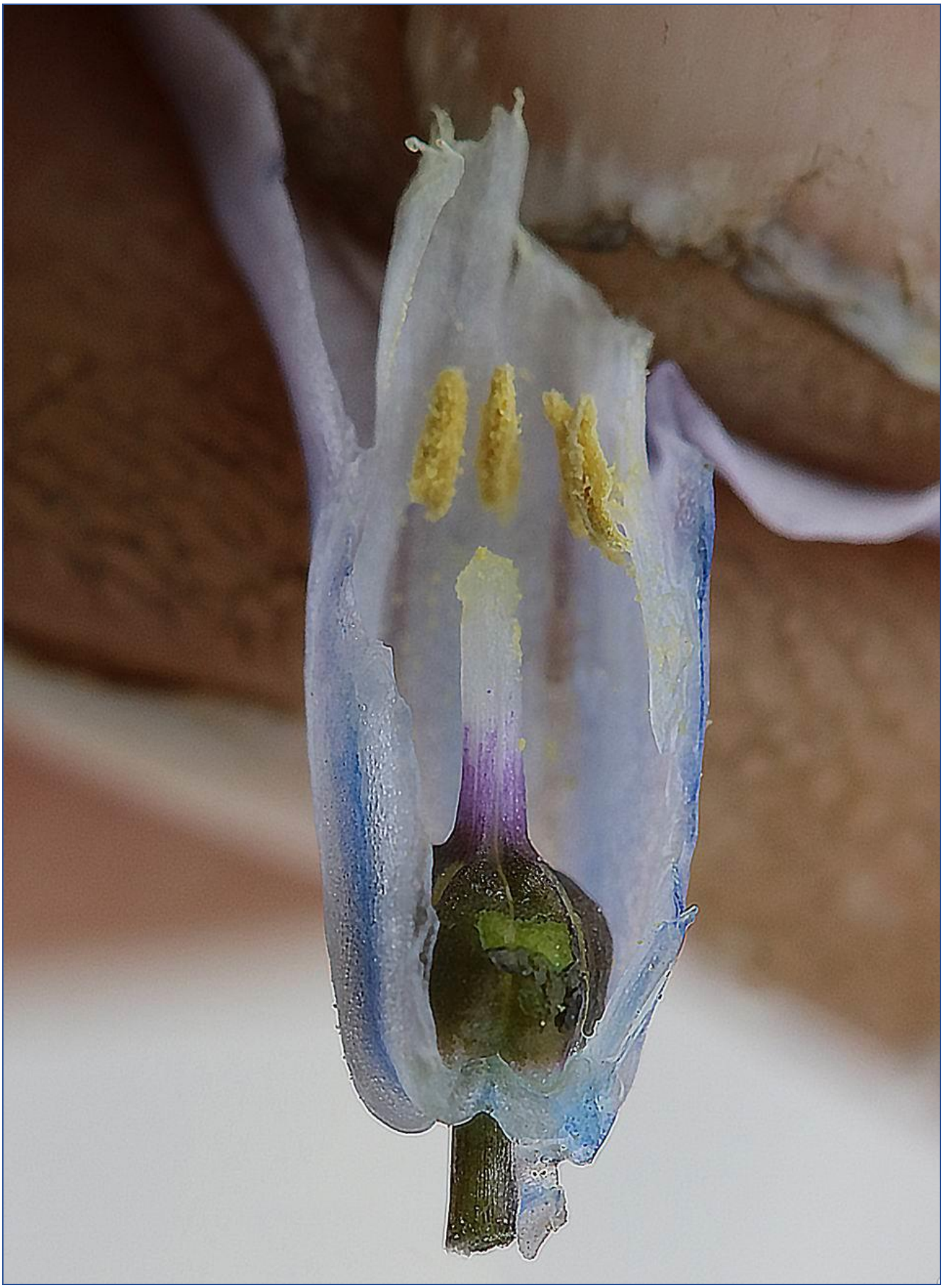
Conservation status – the preliminary conservation status of *P. avromanica* was not assessed due to the insufficient data, but it could be informally evaluated between Vulnerable and Endangered [11] by known number of its locations in the wild (Maps 1 & 2).

Phenology – flowering in the wild: end April - May; fruiting in the wild: June.

Etymology – the name derived from the place name of the new species type locality: Avroman or Hawraman (translated from the Avestan language as *"Territory of Sun"*), a mountainous region located within central section of the Zagros Mountains [12] (the provinces of Kurdistan and Kermanshah in western Iran and in north-eastern Kurdistan Region in Iraq) and populated with the Hawrami Kurdish people.

Puschkinia avromanica 18IRS-026 – in habitat, W Iran.

Puschkinia avromanica 18IRS-026 – in habitat, W Iran.



The key diagnostic morphological character in *Puschkinia avromanica* – a white style distinctly violet at the lower half.

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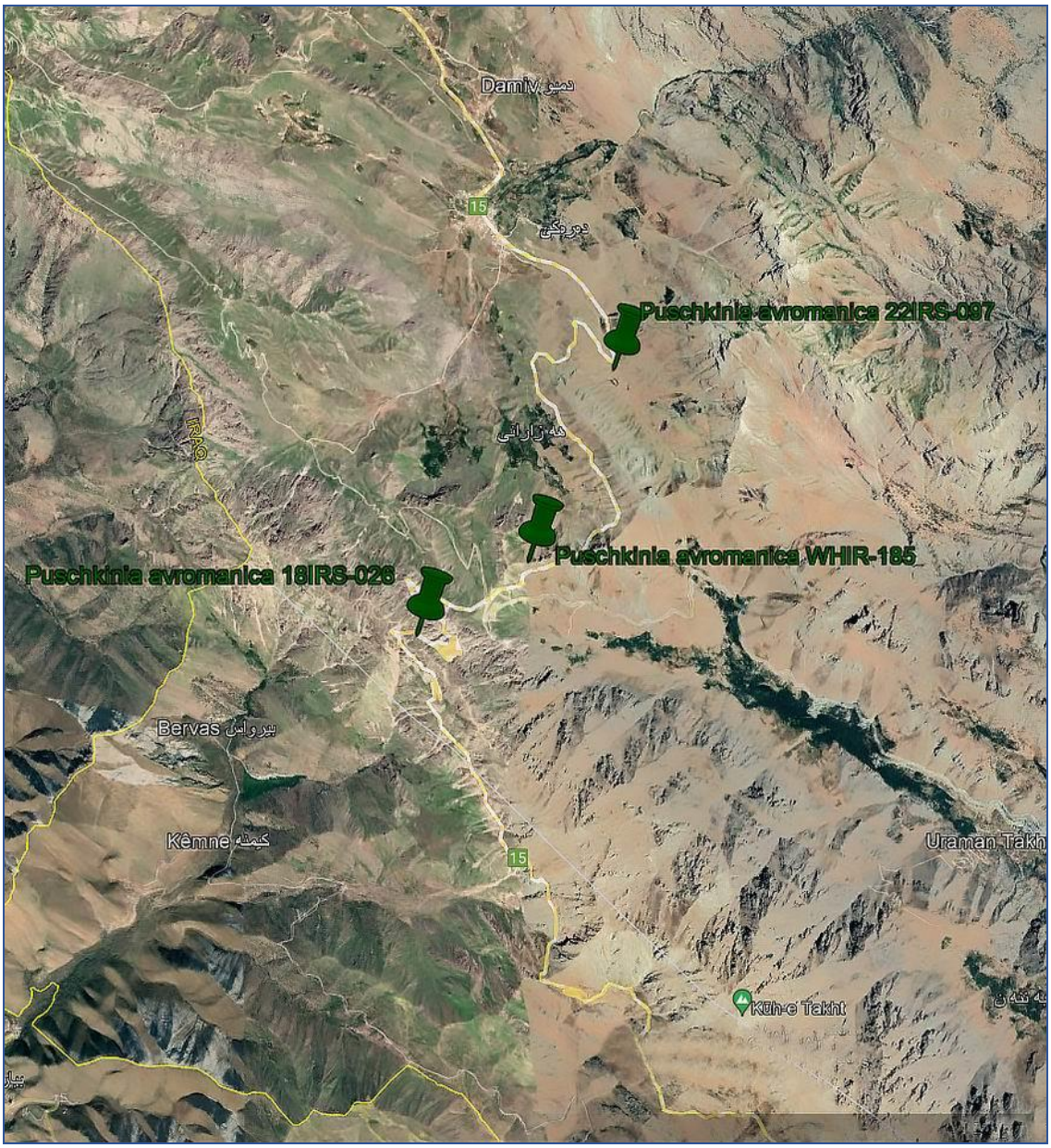
Puschkinia avromanica bulbs.

Puschkinia avromanica fruits.



Map 2: The disclosed *Puschkinia avromanica* localities within western Iran.

Mountain slopes in Avroman region, where *Puschkinia avromanica* grows, W Iran.

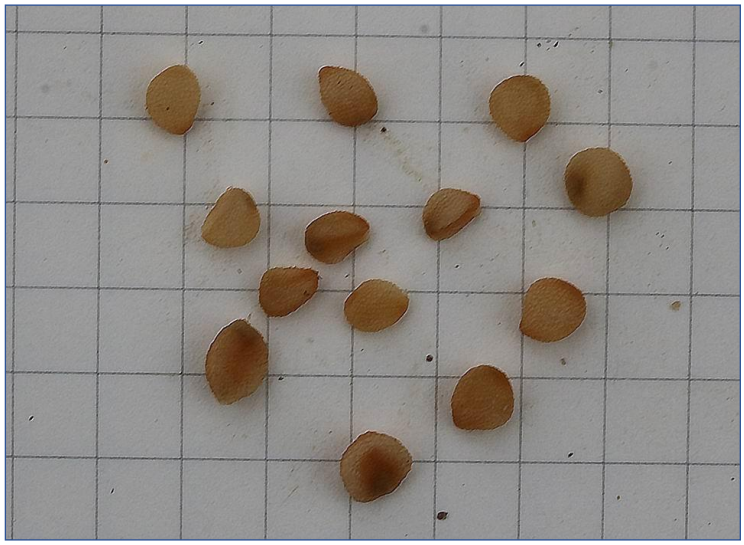
A type locality of *Puschkinia avromanica* within submontane zone vegetation composed of *Prangos uloptera - Psathyrostachys fragilis* community: Central Zagros – Avroman, 2563 m, Kurdistan Province, W Iran.

Puschkinia avromanica 18IRS-026 – cultivated in Ukraine, Kyiv Region.

Puschkinia avromanica – close-up of flower.

Below, right:
Flowers of *Puschkinia avromanica* 18IRS-026 – cultivated.

Left: *Puschkinia avromanica* – a holotype deposited at GB herbarium.



Puschkinia avromanica seeds.

Puschkinia avromanica – an isotype deposited at RIG herbarium.

Puschkinia avromanica – a fruiting herbarium specimen.

The key features separating *P. avromanica* from the allied species (*P. scilloides*) were compared with samples grown in our collections and originally collected in Armenia: nr. Vanadzor (an accession no. 14ARM-037, 1400 m elevation), nr. Geghard (an accession no. 14ARM-042, 1800 m elevation), The Zangezur Mountains (at border between Armenia and Azerbaijan: Nakhchivan, 1800 m elevation); in Georgia: Devdaraki valley (an accession no. CMGG-028, 1700 m elevation); in Turkey: at Güzeldere Pass (an accession no. BATM-089, 2700 m elevation), at Tendürek Pass (an accession no. BATM-148, 2650 m elevation); in Iran: Kūhhā-ye Ţālesh, between Nav and Khalkhal (an accession no. WHIR-126, 2100 m elevation), Takht-e Soleyman Massif (an accession no. WHIR-151, 2600 m elevation), Kuhha-ye Sabalan (an accession no. 18IRS-072B, 2700 m elevation). All observed *P. scilloides* plants had non-stoloniferous bulbs, flower tube *c.* 1/3 of perianth length, elongated ovary, and pure white style. In other words, they were easily separable from *P. avromanica* sp. n. In April 2022 our team revisited a type locality of *P. avromanica*. This time, a site (from where the type specimens were collected) was under deep snow, but an opposite slope was already melted (a contrary snow situation to that observed in May 2018). There were flowers revised from seven distant puschkinia groups and they all revealed the same morphological features inherent to the newly described taxon. Special attention was given to the flower proportions and colour of a style. Moreover, the identical plants were also found on the same ridge at much lower altitude in a landscape depression (1870 m), where few plants still had flowers, whilst on more open slopes they already started forming fruits.

Puschkinia latifolia – cultivated in Ukraine, Kyiv Region.

Puschkinia latifolia SLIZE-066 – cultivated, from Central Alborz, N Iran.

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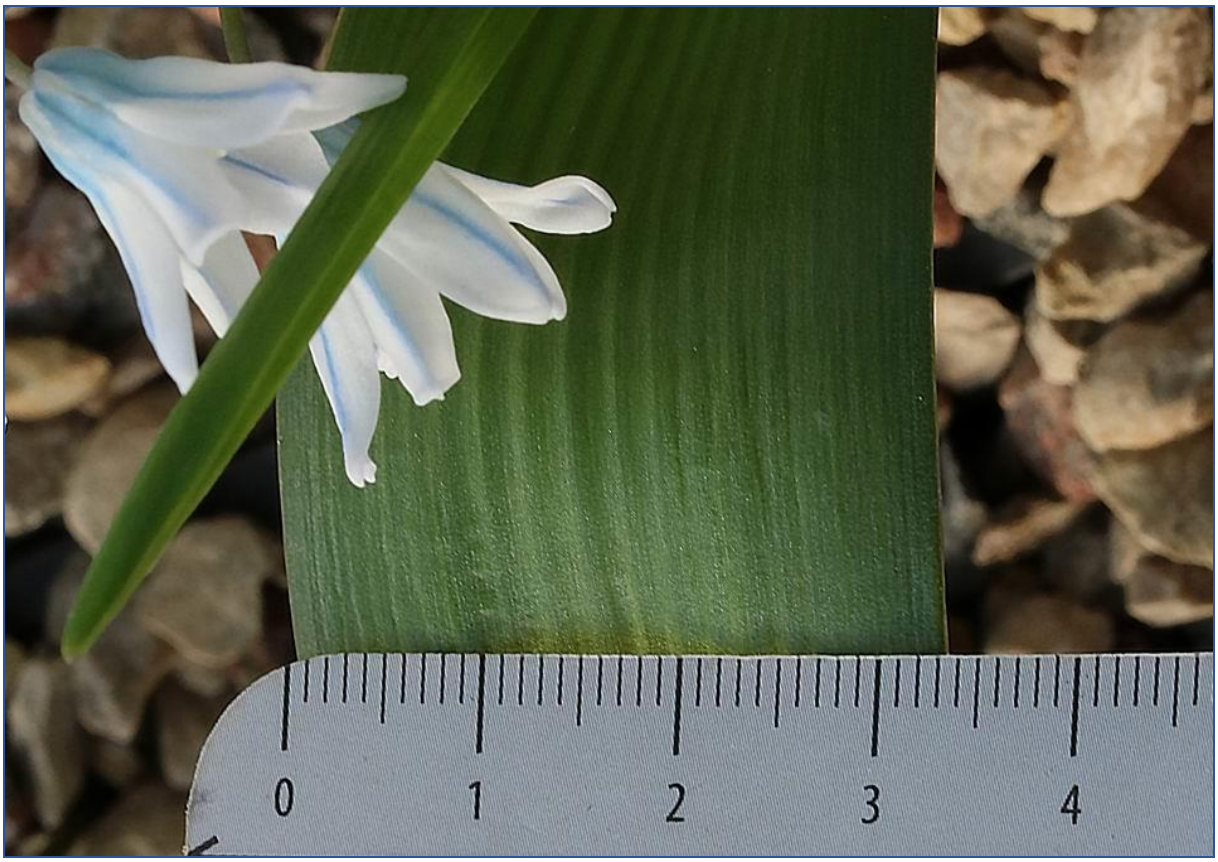
At the border of Māzandarān and Alborz Provinces in Central Alborz

During the 1988 SLIZE expedition (**S**wedish-**L**atvian-**I**ranian **Z**agros **E**xpedition), Dr. Arnis Seisums (National Botanic Garden of Latvia) together with Dr. Magnus Lidén (Uppsala University, Sweden) and Dr. Magnus Popp (Natural History Museum, Norway) found a very special looking *Puschkinia sp.* with unusually wide leaves. It was observed not far from Siah Bisheh village at the border between Māzandarān and Alborz Provinces in northern Iran (an accession no. SLIZE-066). The leaves were almost twice as wide than in any other known *Puschkinia* samples observed by us in the wild or in cultivation. We also know that *P. scilloides* is listed in Flora Iranica (1990) from the vicinities of Siah Bisheh vill.: *Persia: N: Maz.: Siah Bisheh, 2200 m, WDB. & SHIRDELPUR 11685* [16]. Nevertheless, even the biggest plants of *P. scilloides* with the largest flower racemes seen in the wild in Iran (an accession no. WHIR-126, Kūhhā-ye Ţālesh between Nav and Khalkhal, 2080 m elevation; an accession no. 18IRS-072B, slopes of Kuhha-ye Sabalan, 2700 m elevation; and some other accessions from Armenia) had only half of the leaf width observed in that accession no. SLIZE-066. According to the Flora of Turkey and the East Aegean islands [5], *P. scilloides* should have a bulb size up to *c.* 2 cm in diam. and a leaf width as 0.2-1.3(-1.8) cm. In contrary, the leaf blade span of an accession no. SLIZE-066 varied within 30-38(-52 in cultivation) mm wide (measured in the widest blade part), and a bulb size reached 32-38(-44) mm in diameter.

Puschkinia latifolia leaf blade shows ‘reticulate’ adaxial surface; cultivated in Ukraine, Kyiv Region.



Puschkinia latifolia leaf width.

The leaf width in cultivated broad-leaved *Puschkinia scilloides* WHIR-126 from Kuhha-ye Talesh, NW Iran.

To confirm our thoughts on the uniqueness of this puschkinia, an accession no. SLIZE-066 was planted among different specimens of *P. scilloides*, including the described here *P. avromanica* sp. n., and mentioned here above other accessions from Armenia, Iran, Turkey and Georgia.

And then again, the seedlings were placed among other samples within three generations since the first bloom of ‘SLIZE-066’ in our collections in spring 2000. Even plants from F3 generation kept the same extremely wide leaf blade in uniform mature individuals. It is confirmed that such wide leaves are an inherited feature that allow us to think that ‘SLIZE-066’ did not cross with all other puschkinia samples growing together in cultivation. As a rule, we observed in cultivation that accession produces two very dense racemes, and even gives a third raceme with few flowers in mature plants in some seasons. Therefore, those sole leaf and bulb morphological characters enjoyed us to think about one more new puschkinia species from the Alborz mountains in N Iran – *Puschkinia latifolia* (the broad-leaved puschkinia).

Puschkinia latifolia – a holotype deposited at GB herbarium.

Puschkinia latifolia Rukšāns & Zubov **sp. nov.**

Type: Iran, near border of Māzandarān and Alborz Provinces, Siah Bisheh vill. vic., 36°12' N and 51°20' E, meadows on lime-stone cliffs at 2250 m elevation; cult. (specimen grown from seed in J. Rukšāns' garden, Latvia), *fl.* 29 Mar. 2020, *Rukšāns* s.n. (holotype GB!).

Bulb – *c.* 30 mm long, 32-38(-44) mm in diam., rounded, slightly flattened, covered with previous years' greyish brown tunics, inner tunics greyish white; adventitious roots white, unbranched.

Leaves – 2, supervolute, the inner leaf smaller in size, spaced apart, distinctly exceed scape length, up to 15-20 cm long and 30-38(-52 in cultivation) mm wide, thick, strap-shaped, bright green with reddish brown base, distinctly ribbed (sometimes 'reticulate' patterned adaxially), channelled at the base, but almost flat in the middle and upper part, distinctly cuculate at the top with pointed apex.

Scape – (1-)2 (-3 in cultivation), erect to slightly arcuate, robust, up to 16 cm long and 5-6 mm in diam., brownish shaded green at the base, lightens to soft green to the upper part; *raceme* simple, dense, ±cylindrical.

Flowers – 15-20, funnel-shaped, 18-19 mm long and *c.* 20 mm in diam.

Perianth segments – 6, connate at the base to form a tube *c.* 1/3 of a perianth length; *perianth tube* 4-5 mm long; *segment free parts c.* 3 times longer – 13-14 mm long and *c.* 7 mm wide, white, blurred greyish on tube abaxially, midrib contrast, blue; *pedicels* unequal, erecto-patent to patent, green turning dirty brownish or purplish shaded just below flowers, lower – up to 15-20 mm long, upper – 3-4 mm long; *bracts* obsolete, ±bifid, whitish, membranous, irregularly and shallowly dentate, with a small lilac torus at the base.

Androecium – *stamens* 6; the bases of the stamens flattened and closely clustered in the ±middle of a perianth and connate to form a conical, creamy white, 6-lobed *corona c.* 7 mm long; *corona lobes* (alternating with stamens) *c.* 2 mm long, shallowly bilobed at the top; *filaments* obsolete, white, less 1 mm long; *anthers* epipetalous, adnate adaxially between the base of corona lobes, subsessile, dorsifixed, versatile, introrse, narrow ovoid, 2-2.5 mm long, yellow; *pollen* yellow.

Gynoecium (ovary and receptacle) – syncarpous, tricarpellate; *ovary* superior, sessile, elongated (almost twice longer than wide), indistinctly 3-ribbed, brownish green, up to 3-5 mm long and 2-2.5 mm in diam.; placentation axile, ovules up to 10-12 per locule; *style* short, erect, *c.* 2 mm long, white; *stigma* small, white, capitate.

Fruit – a membranous, loculicidal *capsule*: *c.* 17 mm long and *c.* 15 mm in diam., ±spherical, slightly 3-ribbed with a little beak at the top, straw green and persistent faded perianth and style.

Seeds – ±ovoid, up to 4 mm long and 2.5-3 mm wide; *testa* pale golden brown, alveolate, glabrous.

Recognition – morphologically similar to *P. scilloides*, but differs by having large, rounded, slightly flattened bulb 32-38(-44) mm in diam.; extremely broad, strap-shaped leaf blade 30-38(-52) mm wide; and usually 2(-3) flower scapes (*vs* small- to medium-sized, ovoid-globose bulb 12-25 mm in diam.; ±lanceolate leaf blade 10-20(-25) mm wide; and usually 1 flower scape in *P. scilloides*).

Distribution – Western Asia: Iran, central section of the Alborz mountain range; possibly a local Central Alborz endemic. Map 1.

Specimens examined – Iran. Near border of Māzandarān and Alborz Provinces, Siah Bisheh vill. vic., 36°12' N and 51°20' E, meadows on lime-stone cliffs at *c.* 2250 m elevation; cult. (specimen grown from seed in J. Rukšāns' garden, Latvia), fl. 29 Mar. 2020, *Rukšāns* s.n. (holotype GB!). The exact locality of *P. latifolia* has not been documented here for fear of unlawful plant collecting.

Habitat – found above north facing slope occupied by oak forest (*Quercus macranthera* Fisch. & Mey.), on meadows of submontane zone within vegetation composed of *Prangos uloptera - Psathyrostachys fragilis* community [2, 15], underlying lime-stone cliffs at 2200-2350 m elevation; currently known only from the type locality, but could be distributed within wider area of the Alborz mountains.

Conservation status – the preliminary conservation status of *P. latifolia* was not assessed due to the insufficient data, but it could be informally evaluated between Vulnerable and Endangered [11] by known number of its locations in the wild (Map 1).

Phenology – flowering in cultivation: March - April; fruiting in cultivation: May.

Etymology – the new species name reflects its extremely broad leaves.

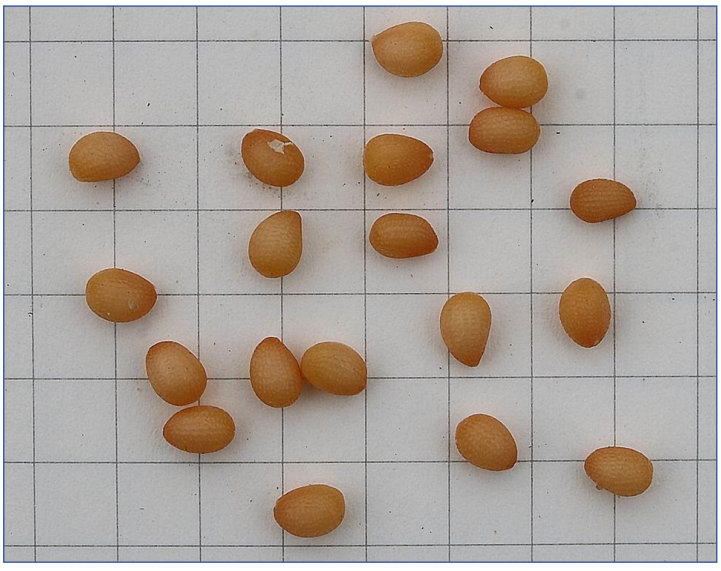
The main features separating *P. latifolia* sp. n. from similarly looking *P. scilloides* are the distinctly wider leaves and larger flattened bulbs, as well as 2(-3) scapes per a mature bulb. Even plants with the largest flower scapes observed by us had much narrower leaf blades (an accession no. KPPZ 90-221, Turkey, between Tunceli & Erzincan, has a maximum leaf width 15 mm; an accession no. WHIR-126, Iran, Kuhha-ye Talesh, between Nav and Khalkhal, has a maximum leaf width 16 mm). But these accessions (by overall view

resembling hyacinths when flowering, so huge and dense racemes they produce), have much narrower leaves and smaller bulbs than described here *P. latifolia* sp. n.

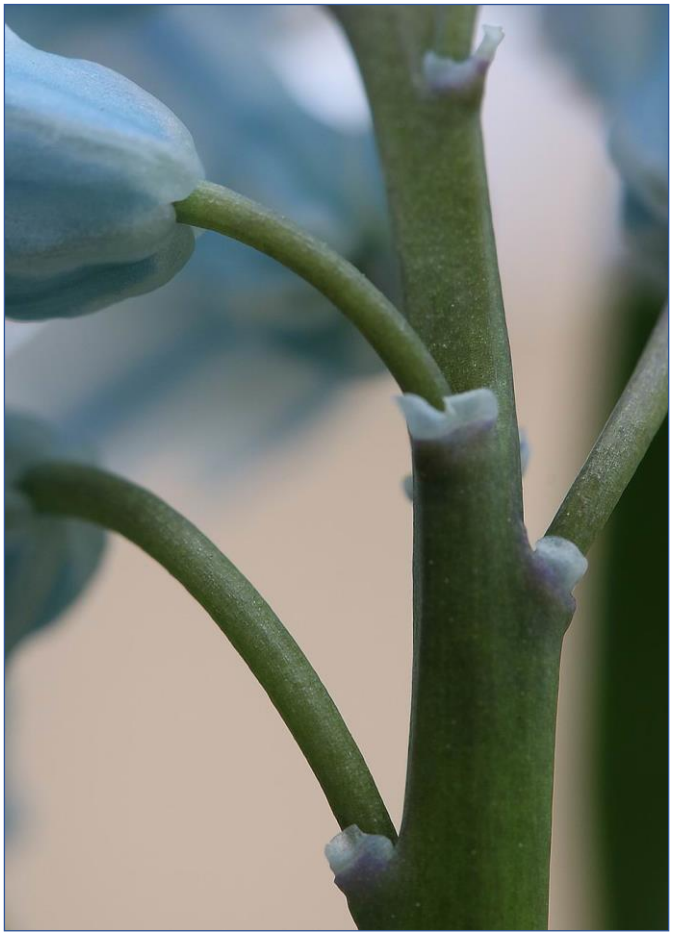
Puschkinia latifolia – flower details.

Puschkinia latifolia flower details.

Puschkinia latifolia fruits.



Puschkinia latifolia seeds.



Puschkinia latifolia bracts.

Puschkinia latifolia bulbs.

The Lake Urmia south-western & western vicinities

During the same 2018 Iranian IRS expedition, 15 km to the west of Mahabad city, at 1600 m elevation, among the slopes covered with fruiting *Iris bakeriana* Foster, within a community of *Astragalus mesoleios* and *Psathyrostachys fragilis* [2, 15], D. Zubov found a tiny puschkinia in fruits (an accession no. 18IRS-060B). Unlike the famous *P. scilloides*, usually growing as solitary plants, that tiny puschkinia grew as short, compact, multi-leaved clumps. Such a growing habit greatly interested Zubov, and he collected several specimens. A year later, in his garden, that new puschkinia bloomed, retaining delicate morphological features and the campanulate-shaped flowers scattered on a lax few-flowered raceme. Moreover, it became clear that the mother bulb forms around the small daughter bulbils with a single hollow cylindrical leaf each, which is completely uncharacteristic for any *Puschkinia* species known at that time. Then D. Zubov immediately decided that this was a noteworthy new *Puschkinia* species with the tiniest habit and bulbil-forming/clumping capacity.

A type locality of *Puschkinia parvula* – among phrygana vegetation within community of subshrub of thorny *Astragalus mesoleios* and *Psathyrostachys fragilis*: south-western section of Lake Urmia basin, 2250 m, West Azerbaijan Province, NW Iran.

Moreover, in the frame of the 2022 Iranian expedition, J. Rukšāns went to N & W Iran in search of a unique floral discovery made by an Iranian mountain climber. A climber pictured occasionally a spring blooming crocus with yellow flushed brown flowers, somewhere in the mountains to the south-west of Lake Urmia in West Azerbaijan Province.

There was no similarly coloured crocus known in that region, neither on Iranian side nor on Turkish/Iraq side of border. There are only two species of crocuses with yellow flowers known in Iran at the moment – *Crocus almehensis* C.D. Brickell & B. Mathew from Golestan Province and *C. kurdistanicus* (Maroofi & Assadi) Rukšāns from the Hamedan city vicinity, both with pure yellow flowers and distributed in the wild far to the east and south.

Unfortunately, J. Rukšāns was there far too early: those mountains were still under a 3-4 m thick layer of snow. About 6 km before a supposed crocus locality, his ascent was stopped by very deep snow crossing road up. The local border guards met on the spot confirmed that such a yellow crocus grew there, but that it does not bloom earlier than in May. During the ascent, shortly before the highest passable point of the road, he found a beautiful and very tiny *Puschkinia sp.* with very small flowers, superficially resembling *P. avromanica* sp. n., but forming flower scapes with up to 10 flowers, which were significantly smaller by size and rather of campanulate shape (an accession no. 22IRS-077, at 2250 m elevation). There was very strong wind at that locality, so no good photo *in situ* was received. All illustrations from that accession published in this paper are made later by collected flowers and herbarium sheets. Really the fact about discovery of a new species was realized only in the late evening on that day, when sorting out the gathered material. It was Janis' roommate Vaclav Jošt, a plantsman from Czech Republic, who drew his attention to the strange flower size and shape of that *Puschkinia.* So, after checking 5 plants collected by Janis and another 5 collected by V. Jošt, it became clear that another new *Puschkinia* species was found in mountains in the south-western part of Lake Urmia basin. The further *ex situ* flower morphology check-up showed that new *Puschkinia* species has almost similar proportion of flower tube and free perianth segment length as in *P. avromanica* sp. n. Similarly, its ovary is rounded, not elongated like in *P. scilloides*, but its style is white and greenish at the base. Although *P. avromanica* sp. n. possesses a white style, which is distinctly violet at the lower half.

Later, in personal communication, we found that identical tiny plants were collected already in 2018 by D. Zubov during the 2018 Iranian IRS expedition. Both collection localities (those of years 2018 and 2022) were only about 50 km away from each other. Similarly, only after checking the collected material and pictures, we found that the same little puschkinia was also observed in third locality – between Agh Bolagh and Lowlakān villages, at 2170 m elevation, that is about 30 km to the north from a type locality. Therefore, taking into account

the exclusive morphological features of that tiny puschkinia from the Lake Urmia south-western & western vicinities in NW Iran, we decided to name it as *Puschkinia parvula* (the little puschkinia).

Puschkinia parvula – a holotype deposited at RIG herbarium.

Puschkinia parvula 18IRS-060B cultivated in Ukraine, Kyiv Region.

Puschkinia parvula Rukšāns & Zubov **sp. nov.**

Type: Iran, West Azerbaijan Province: to the west from Oshnaviyeh city, 36°56' N, 44°57' E, 2250 m elevation, *fl.* 11 Apr. 2022, *Jošt & Rukšāns* sp. n. (holotype RIG!).

Bulb – 7-12 mm in diam., *c.* 20 mm long, narrowly ovate to ovate with a pointed apex, covered with previous years' dark greyish brown tunics, inner tunics greyish white; clumping: a main bulb produces 1-3 smaller daughter bulbs (bulbils) under the covering tunics; adventitious roots white, unbranched.

Leaves – 2, supervolute, the inner leaf smaller in size, ±upright, up to 9-17 cm long and 7-15 mm wide, lanceolate, flared upward and canaliculated, bright green with reddish brown base, distinctly cuculate at the top with pointed pinkish white apex; a bulbil leaf solitary, 8-15 cm long and 0.3-0.4 mm in diam., upright, cylindrical, hollow, bright green with reddish brown base and pointed pinkish white apex.

Scape – 1, erect, thin, *c.* 7 cm long, bright green with reddish brown base and flower-bearing upper part; *raceme* simple, lax.

Flowers – 2-8(-10), ±campanulate, 10-12 mm long and 6-8 mm in diam.

Perianth segments – 6, connate at the base to form a tube *c.* 1/2 of a perianth length; *perianth tube* 4-5 mm long; *segment free parts* ±of the same length – 5-6 mm long and 2-2.5(-3) mm wide, white with weak lilac shade to the top, midrib contrast, dark blue; *pedicels* ±equal, erecto-patent to patent, grey lilac, 3-5 mm long; *bracts* obsolete, semi-concentric, *c.* 1 mm wide, conspicuous, ±bifid, white to whitish-lilac, membranous.

Androecium – *stamens* 6; the bases of the stamens flattened and closely clustered in the ±middle of a perianth and connate to form a conical, white, 6-lobed *corona c.* 8 mm long; *corona lobes* (alternating with stamens) *c.* 1 mm long, irregularly and shallowly dentate at the top; *filaments* obsolete, white, less 1 mm long; *anthers* epipetalous, adnate adaxially between the base of corona lobes, subsessile, dorsifixed, versatile, introrse, narrow ovoid, *c.* 1 mm long, creamy; *pollen* creamy.

Gynoecium (ovary and receptacle) – syncarpous, tricarpellate; *ovary* superior, sessile, rounded, indistinctly 3-ribbed, green, 2-3 mm in diam.; placentation axile, ovules several per locule; *style* short, erect, *c.* 3 mm long, white, greenish at the base; *stigma* small, white, capitate.

Fruit – a membranous, loculicidal *capsule*: *c.* 6 mm long and *c.* 5 mm in diam., ±rounded (weakly elongated to flattened), slightly 3-ribbed with a little beak at the top, straw green with persistent faded perianth and style.

Seeds – few; unevenly ovoid to ±rounded, up to 2-3 mm in diam.; *testa* golden brownish, alveolate, glabrous.

Recognition – morphologically similar to *P. scilloides*, but differs by having a main bulb surrounded by 1-3 small daughter bulbils; a clumping habit; few-flowered (2-8(-10) lax raceme; usually equal pedicels; usually campanulate flowers 10-12 mm long and 6-8 mm in diam.; perianth tube *c.* 1/2 of a perianth length; and rounded ovary with white, greenish at the base style (*vs* a main bulb without daughter bulbils; a solitary, non-clumping habit; multi-flowered (>10) dense cylindrical raceme; unequal pedicels; funnel-shaped flowers 10-20 mm long and 12-18 mm in diam.; perianth tube *c.* 1/3 of a perianth length; and elongated ovary with pure white style in *P. scilloides*);

– morphologically similar to *P. avromanica*, but differs by having a main bulb surrounded by 1-3 small daughter bulbils with a solitary, hollow, cylindrical leaf each; lax raceme with up to max. 6-8(-10) flowers; usually equal pedicels; usually campanulate flowers 10-12 mm long and 6-8 mm in diam.; ovary with white, greenish at the base style; and leaf bases straw to brownish *in exsiccatae* (*vs* usually a stoloniferous bulb with 1-2 side-directed leafless stolons; lax raceme with up to max. 4(-5) flowers; unequal pedicels; funnel-shaped flowers 9-16 mm

long and *c.* 20 mm in diam.; ovary with white style distinctly violet at the lower half; and leaf bases bright violet *in exsiccatae* in *P. avromanica*).

Distribution – Western Asia: Iran, the south-western & western sections of Lake Urmia basin; possibly a local extreme NW Zagros Mts./ W & SW Urmia endemic. Maps 1 & 3.

Specimens examined – Iran. West Azerbaijan Province: to the west from Oshnaviyeh city, 36°56' N, 44°57' E, 2250 m elevation, *fl.* 11 Apr. 2022, *Jošt & Rukšāns* sp. n. (holotype RIG!). The exact localities of *P. parvula* have not been documented here for fear of unlawful plant collecting.

Habitat – on open slopes, but mostly among phrygana vegetation within community of subshrub of thorny *Astragalus mesoleios* and *Psathyrostachys fragilis* [2, 15] on gravel soils, accompanied by seasonal geophytes – *Crocus dolatyarii* Rukšāns, *C. chiaicus* Dolatyari & Rukšāns, *Gagea* sp., *Colchicum szovitsii* Fisch. & C.A. Mey., *etc.,* observed at 1600-2250 m elevation. At present known only from three localities, but could be distributed wider within NW extreme end of the Zagros Mts.

Conservation status – the preliminary conservation status of *P. parvula* was not assessed due to the insufficient data, but it could be informally evaluated between Vulnerable and Endangered [11] by known number of its locations in the wild (Maps 1 & 3).

Phenology – flowering in the wild: end March - April; fruiting in the wild: May.

Etymology – the new species name reflects an overall plant habitus and tiny-sized flowers, the smallest among all known *Puschkinia* species at the moment.

Right: *Puschkinia parvula* fruits.

Left: *Puschkinia parvula* seeds.

Mature flowering plants of *Puschkinia parvula* 18IRS-060B (on the left) vs *Puschkinia avromanica* 18IRS-026 (on the right); cultivated in Ukraine, Kyiv Region.

Map 3: The disclosed *Puschkinia parvula* localities within north-western Iran.

A. Key to the identification of *Puschkinia* species (*fide* J. Rukšāns)

1 Inflorescence hemispherical to conical, corona with entire edge …….. ***P. bilgineri***

1 Inflorescence ±cylindrical, corona with lobed edge

2 Flowers green or bluish lilac

3 Flowers greenish, pedicels 2-7 mm long, pending, raceme straight

or with slightly bent tip…….. ***P. peshmenii***

3 Flowers bluish to lilac blue, pedicels 7-50+(lowest) mm long, raceme curved ……..…….... ***P. kurdistanica***

2 Flowers whitish with blue midrib, pedicels up to 15 mm long, spreading

4 Leaves 30-38(-52) mm wide ……..... ***P. latifolia***

4 Leaves up to 2 cm wide

5 Free part of segments of almost same length or less than twice as long than tube, ovary rounded

6 Flowers 1-4(-5) on scape, up to 17 mm in diameter, style violet at base …….. ***P. avromanica***

6 Flowers up to 8-10 on scape, up to 8 mm in diam., style throughout white or greenish at base...***P. parvula***

5 Free part of segments at least 2.5-3 times longer than tube, ovary elongated, ovate ……..…… ***P. scilloides***

B. Key to the identification of *Puschkinia* species (*fide* D. Zubov)

1 Floral corona entire, lobeless; raceme dense, conical to hemispherical……..... ***P. bilgineri***

1 Floral corona dentate; raceme of a different shape, either lax or dense ……2

2 Perianth tube c. 1/2 of perianth length; raceme lax …….. 3

2 Perianth tube c. 1/3 of perianth length; raceme dense ..……...…… 4

3 Flowers up to 4-5, c. 16 mm long, broadly funnel-shaped; style white, distinctly violet at the lower half ……..…….. ***P. avromanica***

3 Flowers up to 6-8(-10), c. 10 mm long, campanulate; style white, greenish at the base……..…….. ***P. parvula***

4 Raceme common, erect; flowers bluish white usually……..... 5

4 Raceme unilateral, erect or arcuate; flowers of other colouration……..... 6

5 Leaf blade width 30-52 mm, usually with ‘reticulate’ adaxial surface; usually with 2 flower scapes……..……..…… ***P. latifolia***

5 Leaf blade width 10-20(-25) mm, with smooth adaxial surface; usually with 1 flower scape ……. ***P. scilloides***

6 Flower scape distinctly arcuate; flowers bluish lilac; style obsolete, less 1 mm long... ……. ***P. kurdistanica***

6 Flower scape ±erect to ±upward refracted; flowers green to bluish-green; style erect, up to 2-3 mm long ……. ***P. peshmenii***

In general, seven *Puschkinia* species are already known within the previously monotypic (until 2007) Western Asian genus, including these three new ones actually described from Iran:

- *P. scilloides*: Taurus Mountains, Armenian Plateau – Turkey: E & SE Anatolia, Armenia; Near East/Levant – Syria, Lebanon; Ciscaucasia – S Russia: Stavropol Krai; E Caucasus – S Russia: Dagestan; Greater & Lesser Caucasus, Transcaucasia, Talysh – Georgia, Armenia, Azerbaijan; Iranian Plateau: Zagros mountains & Alborz mountains, Algurd Dagh, Kuh-e Varvasht, Sahand Mt., Takht-e Soleyman Massif, Kiyamaki Dagh, Alvand Kuh, Rasvand Mts., Kuhha-ye Sabalan – N Iraq, N & NW Iran;
- *P. peshmenii*: eastern end of the Taurus mountains (Bitlis Dağları, Hakkari Dağları) – Turkey: E Anatolia (Van & Hakkari Provinces);
- *P. bilgineri*: eastern end of the Taurus mountains (İhtiyarşahap (Kavuşşahap) Dağları) – Turkey: E Anatolia (Van Province);
- *P. kurdistanica*: south-eastern part of the Armenian Plateau (southern shoreside of Lake Van) – Turkey: E Anatolia (Van Province);
- *P. avromanica*: Zagros Mountains (Central Zagros: the Avroman mountainous region) – W Iran: Kurdistan Province;
- *P. latifolia*: Alborz mountains (Central Alborz) – N Iran: Māzandarān & Alborz Provinces border area;
- *P. parvula*: north-western end of the Zagros mountains (south-western & western sections of Lake Urmia basin) – NW Iran: West Azerbaijan Province.

Moreover, for the first time we assume here the main and important '*The Armenian Plateau-Taurus-Zagros speciation and biodiversity center for the genus Puschkinia'* located within mountainous area to the south & east of between Lake Van (eastern end of the Taurus Mountains & south-eastern part of the Armenian Plateau, E Turkey) and Lake Urmia (north-western end of the Zagros mountains, NW Iran). It comprises the distribution areas (in north-

western → south-eastern direction) for the following taxa: *P. peshmenii* (most distant north-western member), *P. bilgineri, P. kurdistanica, P. scilloides* (partially), *P. parvula,* and *P. avromanica* (most distant south-eastern member).

Puschkinia parvula 22IRS-050 – in habitat, to the west of Agh Bolagh village, 2170 m, NW Iran.

Acknowledgments

At first we express our thanks to our Iranian guide Sholeh Jalili Khiabani, who led our group in 2018 within western Iran and to Dr. Alireza Dolatyari, who invited us to take part in the 2022 Iranian expedition, giving us a great improvement in our knowledge about the geophyte flora of Iran, and, of course, to all other our team partners, especially to Vaclav Jošt (Czech Republic), for their support in search of new plants and the herbarium preparation. And we are especially thankful to our families for the hard work at our gardens during our absence, because of the field studies *in situ*.

References

1. Adams, J.M.F. (1805). Desriptio novi plantarum generis. *Puschkinia scilloides*. In: *Nova Acta Academiae Scientiarum Imperialis Petropolitanae.* Petropoli: Typis Academiae Scientiarum. Vol. 14: 164–166. [In Latin].
2. Akhani, H., Mahdavi, P., Noroozi, J., & Zarrinpour, V. (2013). Vegetation patterns of the Irano-Turanian steppe along a 3,000 m altitudinal gradient in the Alborz mountains of Northern Iran. *Folia Geobotanica* 48(2): 229–255.
3. Baker, J.G. (1871). A revision of the genera and species of herbaceous capsular gamophyllous *Liliaceae*. Gen. 24. Puschkinia, *Adams*. In: *The Journal of the Linnean Society. Botany*. London: Taylor and Francis. Vol. 11: 434–435. [In Latin].
4. Beentje, H. (2016). *The Kew Plant Glossary. An illustrated dictionary of plants terms,* 2nd ed. Kew Publishing, Richmond, 192 p.
5. Edmondson, J. (1984). *Puschkinia* Adams. In: Davis, P.H. (ed.), *Flora of Turkey and the East Aegean islands.* Edinburgh: Edinburgh University Press. Vol. 8: 226–227.
6. Gabrielyan, E.Ts. (2001). Gen. 2. *Puschkinia* Adams. In: Takhtajan, A.L (ed.-in-ch.), *Flora of Armenia*. Ruggell / Liechtenstein: A.R.G. Gantner Verlag KG. Vol. 10 Monocotyledones: 246–248. [In Russian].
7. Govaerts, R. (2022). World Checklist of *Liliaceae*. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; http://wcsp.science.kew.org/. [Retrieved 30 January 2022].
8. Grossheim, A.A. (1940). Gen. 209. *Puschkinia* Adams. In: Grossheim, A.A. (ed.) *Caucasian flora. Cyperaceae – Orchidaceae,* 2nd ed. Baku: Azerbaijan Affiliate of the Academy of Sciences of USSR Press [Baku: Izdatel'stvo Azerbaidzhanskogo Filiala Akademii Nauk SSSR]. Vol. 2: 167. [In Russian].
9. Holmgren, P.K., Holmgren, N.H., & Barnett, L.C. (1990). *Index herbariorum. Part 1: the herbaria of the world*, 8th ed. New York Botanical Garden, New York.
10. IPNI (2022). *International Plant Names Index.* Published on the Internet http://www.ipni.org, The Royal Botanic Gardens, Kew, Harvard University Herbaria & Libraries and Australian National Botanic Gardens. [Retrieved 30 January 2022].
11. IUCN (2019). *IUCN Standards and Petitions Subcommittee, Guidelines for using the IUCN Red List Categories and Criteria.* Version 14. Prepared by the Standards and Petitions subcommittee. http://www.iucnredlist.org/documents/RedListGuidelines.pdf.

12. Karim, K.H., & Abioui, M. (2021). Geology of the Zagros basaltic bodies: examples from the Avroman Mountains, Kurdistan Region, Northeast Iraq. *Journal of Sedimentary Environments* 6(2): 169–188.
13. Mordak, E.V. (2003). Conspectus generum *Hyacinthus* L., *Hyacinthella* Schur et *Puschkinia* Adams (Hyacinthaceae) florae Rossiae et civitatum collimitanearum. *News of Taxonomy of Higher Plants* [*Novosti Sistematiki Vysshykh Rasteniy*] 35: 63–72. [in Russian].
14. Mordak, E.V. (2006). *Puschkinia* Adams. In: Takhtajan, A.L (ed.-in-ch.) & Menitsky Y.L., Popova T.N. (eds.), *Caucasian Flora Conspectus.* St.-Petersburg University Press, St.-Petersburg [Izdatel'stvo Sankt-Peterburgskogo Universiteta, St.-Peterburg]. Vol. 2: 130–131. [In Russian].
15. Noroozi, J., & Körner, C. (2018). A bioclimatic characterization of high elevation habitats in the Alborz mountains of Iran. *Alpine botany* 128(1): 1–11.
16. Rechinger, K.H. (1990). *Liliaceae II, Puschkinia*. In: Rechinger, K.H., Browicz, K., & Wendelbo, P. (ed.). *Flora Iranica*. Graz: Akademische Druck – u. Verlagsanstalt. №165: 132–133; t. 111. [In German & Latin].
17. Rix, M., & Mathew, B. (2007). 582. *Puschkinia peshmenii*: Hyacinthaceae. *Curtis's Botanical Magazine* 24(1): 54–57.
18. Rukšāns, J. (2014). Turkish mountains yield a new *Puschkinia. Alpine Gardener* 82(1): 54–61.
19. Rukšāns, J. (2019). *Puschkinia kurdistanica* (Asparagaceae) – a new species from the shores of Lake Van in Turkey. *IRG* 116: 3–18.
20. Wendelbo, P., & Stuart, D. (1985). *Puschkinia* Adams. In: Townsend, C.C., Guest, E., Omar, S.A, & Al-Khayat, A.H. (ed.). *Flora of Iraq*. Tonbridge: The Whitefriars Press Ltd. Vol. 8 Monocotyledones: 108–109; pl. 29.
21. Yıldırım, H. (2014). *Puschkinia bilgineri* (Asparagaceae subfamily Scilloideae): A new species of *Puschkinia* Adams from the Eastern Anatolia region. *Bağbahçe Bilim Dergisi* 1(1): 1–10. [in Turkish].
22. Zuccarini, J.G. (1843). Plantarum novarum vel minus cognitarum, quae in horto botanico-herbario – que regio monacensi servantur, fasciculus quartus. Liliaceae Juss. Bulbillaria. Zuccar. *Puschkinia libanotica* Zuccar. In: *Abhandlungen der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften*. Munchen: I. Georg Weiss'schen Buchdrucherei, pp. 238–239. [in Latin].

---International Rock Gardener---

--- Species Description ---

Five new *Crocus* species (Liliiflorae, Iridaceae) from north-western and western Iran (preliminary publication)

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Summary. During a joint expedition by both authors to the NW and W of Iran in spring 2022 six new crocus species with ring-like (annulate) corm tunics (former Series *Biflori* Mathew) were observed and their morphological features characterised. Five of them are described here. Photographs and a distribution map are provided. The new species were named, and their holotypes were deposited in the Herbariums of the Iranian Biological Resource Centre (IBRC) and the University of Latvia (RIG).

Key words. Crocus, Flora Iranica, geophyte, Iran, new species.

Our small team - from left Vaclav Jošt, Jānis Rukšāns and Alireza Dolatyari.

Introduction

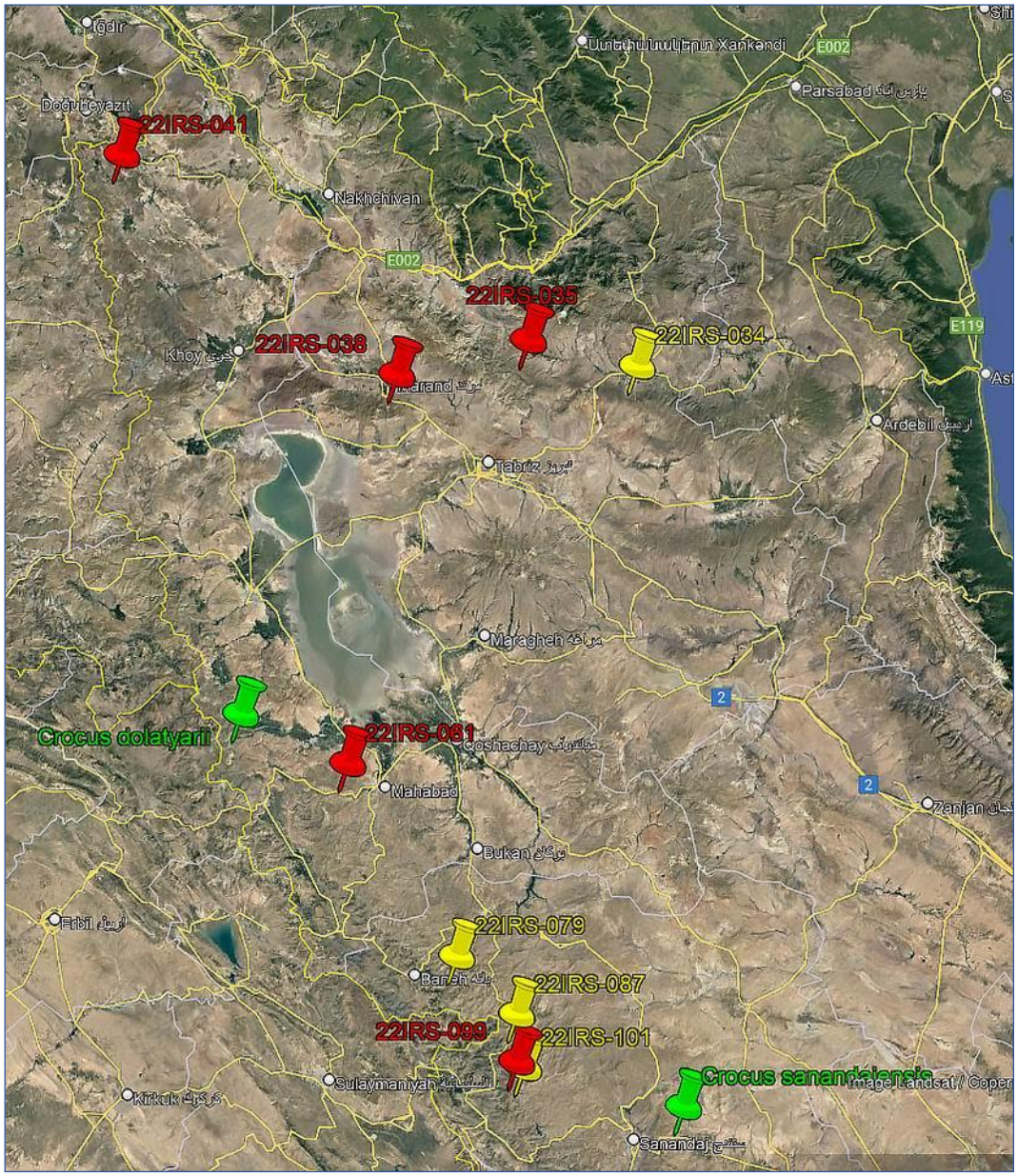
When in 1975, volume 112 of Flora Iranica (dedicated to the family *Iridaceae* [13]) was published, P. Wendelbo and B. Mathew, recognised nine *Crocus* species, but only eight were within the area covered by this Flora, in Iran proper. *Crocus sativus* L. being a cultivated plant not known in nature, was not included. Three of them were spring-blooming species, the other six were autumn bloomers. Two of the spring-blooming species listed in Flora Iranica (*C. almehensis* Brickell & Mathew with yellow flowers and *C. biflorus* Mill. with blue-white flowers) have corm tunics with ring-like structures (annulate).

B. Mathew regarded the yellow *Crocus almehensis* as the most closely related to *C. chrysanthus* (Herb.) Herb. which in the wild grows more than 1500 km to the west and still further westwards [6]. Recent genetic research, however, has shown that its closest relatives are the blue-flowered species occurring in the wild in the Caucasus, NE Turkey and NW Iran. According to Kerndorff & al., the entire aggregate proved to be one of genetically most distinct and largest in the genus and would be later defined as series *Adamii* [3]. B. Mathew and P. Wendelbo in their treatment of *C. biflorus* in Flora Iranica had already listed the name *C. adamii* as its synonym [13].

In 1982 B. Mathew published his excellent monograph “The Crocus. A Revision of the Genus *Crocus*” [6]. In it he treated *C. biflorus* as a complex of different taxa at subspecies level. Unfortunately, he underrated such significant morphological features as the structure and shape of corm tunics, and, in particular the shape of the edge of the basal rings. This was later corrected by Kerndorff & al., who in detail defined the morphological features that are significant while characterising a species in the genus *Crocus* [4]. In 2016 Harpke & al. raised the former subspecies of Mathew and other researchers to species level, in fact, completely disclaiming the use of a “subspecies” as a taxonomical category in the genus *Crocus* [2].

In the new millennium an increasing number of botanists started travelling to Iran which resulted in the discovery of many new taxa earlier unknown to science. A first major step forward in the understanding of the variability of crocuses in Iran was made by J. Rukšāns when he first visited Iran in spring 2008. From the material collected during this trip he subsequently (2012, 2014) published four new *Crocus* species [7,8,9]; after the expeditions of 2016-2018 two more species were added [10,11]. In 2015 and 2016 two trips to Iran were undertaken by H. Kerndorff and E. Pasche. This resulted in three new species published in 2017 [3]. One of the species described by them (*C. sanandajensis* Kernd. & Pasche) had been found by V. Jošt in 2016 and the collected material was shared with J. Rukšāns, who, also, prepared its description; however, H. Kerndorff & E. Pasche were more expeditious.

During the expedition of 2022, our team, following the data made known by the two German researchers, tried to rediscover the other two species they had published. We searched every mountain at the appropriate altitude around Qeidar (Qidār), from where *C. zanjanensis* Kernd. & Pasche was reported but with no results. The same was repeated with *C. zagrosensis* Kernd. & Pasche. The published data proved to be far too approximate or even incorrect. In 2002 Iranian botanists discovered one more species and described it as *C. danfordiae* subsp. *kurdistanicus* Maroofi & Assadi [5]*;* later it was elevated to the species rank by J. Rukšāns [8]. Several researches have been carried out on autumn-blooming crocuses as well, and the first published data allows the assumption that under the name of *C. damascenus* Herb. several distinct taxa are hidden [1]. A very special autumn-blooming crocus in 2021 was found by A. Dolatyari (in preparation) and most likely several more will be added to the *C. speciosus* M. Bieb. group.



Map: Localities where we found crocuses with “annulate” corm tunics: green marks – already published species, red marks – species described in this article and yellow marks – samples whose status must be checked in future.

In spring 2022 our small team guided by A. Dolatyari travelled through NW and W Iran (East Azarbaijan, West Azarbaijan and Kurdistan provinces) observing the localities from where spring-blooming crocuses had been reported earlier or where they might grow according to the experience we had acquired while researching crocuses in their natural habitats. During this expedition six new (one taxon has already been published) spring-blooming crocus taxa were discovered and observed, two localities where crocuses were out of flower had already been known (found in 2018), therefore their descriptions are based on the plants grown and examined in the collection of J. Rukšāns. The leaf morphology of the discovered taxa was researched and characterised by A. Dolatyari from wild collected samples. The distribution map was drawn using specimens and recorded coordinates, verified with the help of Google Earth Pro (©2017 Google) by J. Rukšāns. Further research on the *Crocus* taxa published here in preliminary form will be conducted by A. Dolatyari in laboratory conditions and will be published later.

Crocus marandicus sp. nov. habitat.

Crocus marandicus Dolatyari & Rukšāns **sp. nov.**

Type: Iran, E Azerbaijan Prov. S of Marand, slopes at Payami Ski Resort, 38°20'N, 45°46'E, alt. 1980 m. Holotypus: IBRC! (Her. No. 3526), Isotypus: RIG! (22IRS-038), leg. A. Dolatyari & J. Rukšāns, 08-04-2022.

Habitat and distribution – in grass on a meadow at the base of a steep slope, together with *I. reticulata* s.l.*, Bellevalia sp.* right at the edge of melting snow, at altitudes of 1980-2000 m.
Flowering time – April, fruiting time unknown.
Corm – 10-14 mm in diameter, slightly depressed-globose.
Tunics – hard, coriaceous, sparsely split at the base, subsplits absent.
Tunic neck – 10 mm long, somewhat bristly, formed by widely based triangular splits of the main tunic.
Basal rings – with minutely roughed, almost smooth edges.
Prophyll – absent.
Cataphylls – 3-4, whitish, slightly tinted buff.
Leaves – 3-4, mostly ending below the base of the flowers or reaching it by the time of blooming, glaucous green, 2 mm wide, minutely papillose along the edges and ridge sides, the white stripe very narrow – only around 1/8 of the lamina width, lamina edges slightly bent downward and inward, lateral channels with 2 distinct ribs in each, very rarely one channel with 1 rib.
Perianth tube – variable, from pure yellowish green, flushed or striped greyish only at the top to striped greyish blue on a light greyish base.
Bract and bracteole – silvery to transparent, ending +/- around the base of the flowers.
Throat – glabrous, yellow to greyish yellow, with a diffused more or less conspicuous white upper margin.
Filaments – 4-6 mm long, glabrous, yellow.
Anthers – 8-10 mm long, yellow.
Connective – creamy to very light yellow.
Style – yellow, gradually becoming orange, divided into three, 4-9 mm long branches, widening only at the tips, with a fringed edge, the position in relation to the tips of the anthers variable.
Flower segments – oblanceolate, flowers have a delicate honey scent.
Outer segments – 26-**28**-30 mm long and 8-**9**-10 mm wide, the outside lighter or darker blue with a long dark medial stripe and two or more shorter lateral stripes, almost confluent at the

base forming a narrow dark basal blotch on a yellowish base (transparent from the throat), the inside lighter or darker blue, becoming lighter towards the throat.

Inner segments – slightly shorter than the outer segments but in general of the same width, 25-**26.5**-28 mm long and (8)9 mm wide, darker or lighter blue on both sides, the outside with a small greenish grey basal blotch over a translucent inner throat colour, the inside uniformly blue paling to whitish only shortly before the yellow throat.

Capsule & seeds – not observed.

2n = ?

Etymology – named after Marand, the nearest city to its wild habitat.

Compared with the somewhat similar *Crocus azerbaijanicus* described here, *C. marandicus* has a deep yellow throat with diffused narrow white edge, corm tunics' neck is formed by widely based triangular splits of main tunic and flowers are only faintly scented (vs. *C. azerbaijanicus* where diffused white edge of yellow throat is wide, tunics neck is formed by narrowly based triangular splits of main tunic and flowers have strong scent).

Crocus marandicus blooming in habitat.

Left:

Albino of *Crocus marandicus* in habitat.

Right: *Crocus marandicus* corm tunics.

Crocus marandicus corms.

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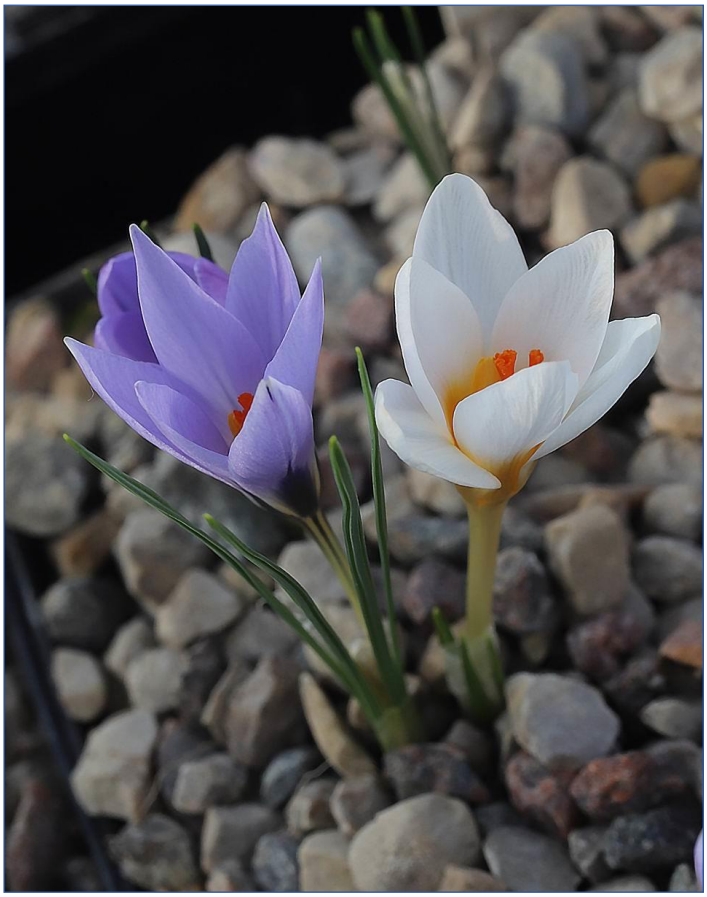
Crocus marandicus - leaf morphology.

Crocus marandicus - flower details.

Holotype herbarium of *Crocus marandicus.*

Crocus marandicus - cultivated plants.



Crocus marandicus - cultivated plants.

Crocus marandicus – in cultivation.

Crocus azerbaijanicus sp. nov. blooming in its habitat.

Crocus azerbaijanicus Dolatyari & Rukšāns **sp. nov.**

Type: Iran, E Azerbaijan Province, near Qahreman Kandi 39°15'N, 44°16'E. alt. 2200 m. Holotypus: IBRC! (Her. No. 3527), Isotypus: RIG! (22IRS-041), leg. A. Dolatyari & J. Rukšāns, 09-04-2022.

Habitat and distribution – wet clay in sparse grass on slopes and near the edge of melting snow at altitudes of 2150-2200 m, growing together with a *Colchicum sp*.
Flowering time – April, fruiting time unknown.
Corm – rounded, up to 18 mm in diameter.
Tunics – hard, coriaceous, the inner tunic only slightly thinner, at the base split into wide segments, mostly without subsplits or they are irregular, shallow and sparse.
Tunic neck – up to 7-10 mm long, with distinctly outwardly bent tips, formed by very narrowly based triangular splits of the main tunic.
Basal rings – less than 1 to 2 mm wide, coriaceous, smooth-edged or insignificantly pronged.
Prophyll – absent.
Cataphylls – 3-4, white, the upper cataphyll sometimes slightly greenish shaded at the very top.
Leaves – (3)4(5), dark greyish green with a papillose surface, 2-3 mm wide, the white stripe very narrow, mostly less than 1/5 of the lamina width, however, there have been observed some individuals with a wider stripe (1/5 to ¼), the lamina with distinctly downward, sometimes even inwardly turned edges, lateral channels with mostly 2 ribs, sometimes in one of the channels had been observed a third poorly developed rib.
Perianth tube – greyish blue or whitish with darker stripes.
Bract and bracteole – silvery, the bracteole slightly longer, reaching the base of the flower segments.
Throat – glabrous, yellow, whitening in the upper part, with a diffused edge, often shaded greyish.
Filaments – glabrous, yellow, 4-**5**-7 mm long.
Anthers – yellow, 7-**10**-12 mm long, with up to 2-3 mm long basal lobes.
Connective – creamy to light yellow.
Style – yellow, becoming orange shortly below the branching, branches 3 mm long (in one out of 20 observed plants the branches were 8 mm long), widening at the very top, the stigmatic surface shallowly lobed, mostly positioned below or level with the anther tips, only rarely slightly longer.

Flower segments – obovate to oblanceolate, with rounded or pointed tips, mainly light blue with or without darker stripes on the outside, rarely pure white; flowers have a very strong honey scent.

Outer segments – 22-**27**-32 mm long and 7-**10**-12 mm wide, the outside light blue, frequently with a small yellowish or dark blue sharply pointed basal blotch, sometimes the blotch striped, rarely the median stripe can reach the segment tips, the inside mostly light blue with a yellow basal part surrounded by a diffused white halo, quite often the yellow is suffused greyish.

Inner segments – 20-**25.5**-30 mm long and 7-**10**-14 mm wide of the same colour as the outer segments, only on the outside the basal blotch slightly paler.

Capsule & seeds –not observed.

2n = ?

Etymology –named after the East Azerbaijan Province where it occurs.

Comparing it with its closest geographical neighbour *C. adamii,* the here described *C. azerbaijanicus* has basal rings with smooth to insignificantly pronged edge (vs. edged with minor, saw-like, somewhat uneven in length teeth in *C. adamii*), its leaves have a papillose surface (vs. glabrous in *C. adamii*), anthers are somewhat less than 2-times longer than filaments and with long basal lobes (vs. 2-3 times longer and with short basal lobes in *C. adamii*). Differences with *C. marandicus* are characterised previously at description of the last species.

Crocus azerbaijanicus corm tunics.

Crocus azerbaijanicus leaf morphology.

Crocus azerbaijanicus

Crocus azerbaijanicus

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Crocus azerbaijanicus in nature.

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Crocus azerbaijanicus in cultivation.

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Crocus azerbaijanicus - holotype herbarium.

Crocus pseudoiranicus sp. nov. flower details.

Crocus *pseudoiranicus* Dolatyari & Rukšāns **sp. nov.**

Type: Iran, Kurdistan Province, along the road to Saquez from Marivan and then up an old road to Tizh-Tizh (Tezh-Tezh) 35°31'N, 46°23'E, at alt. 1590 m, 18IRS-037 leg. J. Rukšāns 5th of May, 2018, on a steep slope with sparse shrubs. Holotypus: RIG! – ex culturae in horto Jānis Rukšāns, 22-02-2019.

Habitat and distribution – wet clay in sparse grass on slopes and near the edge of melting snow at altitudes of 1590-1750 m, growing together with *Crocus damascenus, Fritillaria zagrica, Iris zetterlundii, Allium ubipetrense*(?), *Colchicum sp*. Observed at several localities along an old road to Tizh-Tizh (Tezh-Tezh) in 2018 and 2022.

Flowering time – March, April, fruiting time unknown.

Corm – slightly flattened, round, 12-20 mm in diameter (the size depends on the growing conditions – in 2018 corms were exceptionally large, whereas in the very dry spring of 2022 at the same spot they were only around 12 mm in diameter).

Tunics – outer tunics very hard, woody, inner ones somewhat finer but still hard, split at the base into up to 5-7 mm wide segments, subsplits absent.

Tunic neck – formed by widely based 5-8 mm long triangular splits of the main tunic.

Basal rings – hard, irregular, up to 1.5-2 mm wide, the edge almost smooth, slightly pronged.

Prophyll – absent.

Cataphylls – 4, white, the upper cataphyll slightly greenish at the tip, ending mostly below the flower but rarely even slightly above the base of the flower segments.

Leaves – (3)4-5, emerge during flowering and sometimes reach the base of the flower segments by the end of blooming, dark green, the surface with sparse papillae or minute hairs, the white stripe around 1/5 of the leaf width or somewhat narrower, lamina edges only slightly turned downward, lateral channels with 4 ribs, (3 distinct, one less prominent) yet one of them in most cases poorly developed.

Perianth tube – whitish, striped purplish or turning greenish blue at the base of the flower segments.

Bract and bracteole – transparent, silvery, ending below or almost reaching the base of the flower segments.

Throat – glabrous, small, yellow, with a diffused upper edge.

Filaments – 4-**6**-8 mm long, minutely papillose, yellow.

Anthers – 10-**11.5**-13 mm long, yellow.

Connective – whitish or very light yellow.

Style – orange, generally ends below, even deeper below the tips of the anthers, only rarely ends level with them (in 2 individuals) or overtops the anthers (in 4 plants), as was observed in 30 flowers. Stigmatic branches no more than 4 mm long, not expanded, only rarely up to 6 mm long and slightly expanded, the stigmatic surface fringed to shortly hairy.

Flower segments – white on the inside, the outside densely striped bluish to lilac blue, very rarely the stripes confluent.

Outer segments – 26-**31**-35 mm long and 8-**12.5**-16 mm wide, obovate to oblanceolate with rounded tips, the outside white with a dense bluish-lilac striping almost to the segment edges, darker at the base; the inside white with translucent outer stripes, the base small, deep yellow, with a diffused upper edge.

Inner segments – 26-**29.5**-35 mm long and 9-**12.5**-16 mm wide, obovate with rounded tips, the outside white with less expressed bluish-lilac striping than on the outer segments, the inside similar to that of the outer segments.

Capsule – dark greyish brown, 20-23 mm long and up to 7 mm wide, at ripening positioned just above ground or a bit higher.

Seeds – dark brown, 3 mm long and 2 mm wide, with a distinct caruncle and raphe.

2n = ?

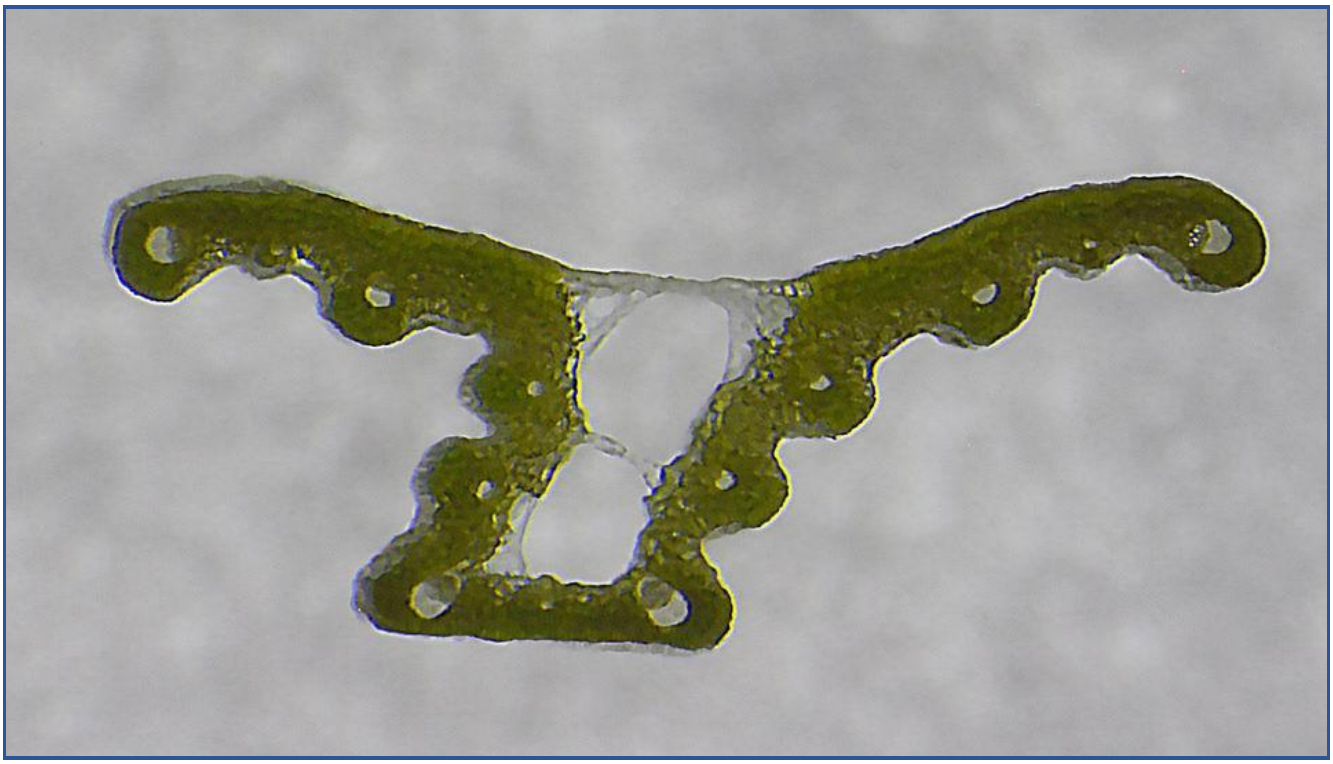
Etymology – named on account of its resemblance to *Crocus iranicus*.

Compared with *Crocus iranicus* it has sparsely papillose or hairy leaf surface (vs. in *C. iranicus* leaves are glabrous), white stripe on lamina surface is around 1/5 or less of leaf width (vs. *C. iranicus* – 1/3) and lateral channels has only 3 distinct and 1 less prominent rib (vs. *C. iranicus* – 5-6 ribs).

Crocus pseudoiranicus corms.

Crocus pseudoiranicus corm tunics.

Crocus pseudoiranicus holotype herbarium.



Crocus pseudoiranicus leaf morphology.

Crocus pseudoiranicus seed capsules and seed.

Crocus pseudoiranicus

Crocus pseudoiranicus

Crocus pseudoiranicus

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Crocus chiaicus sp. nov. in cultivation.

Crocus chiaicus Dolatyari & Rukšāns **sp. nov.**

Type: Iran, West Azerbaijan Province, near Ebrahimen along the road from Urmia to Nahabad via Oschnaviyeh. 36°44'N, 45°32'E, alt. 2070 m, leg. J. Rukšāns 7th of May, 2018, on a steep slope with sparse shrubs (18IRS-059). Holotypus: RIG! – ex culturae in horto Jānis Rukšāns, 23-02-2019.

Habitat and distribution – stony slopes with many different bulbous geophytes: *Tulipa humilis, T. systola, T. biflora* s.l., *Iris aucheri, I. reticulata* s.l., *Crocus damascenus, Leontice leontopetalum*, etc. growing between phrygana shrubs.

Flowering time – March(?), fruiting time unknown.

Corm – somewhat flattened, round, 12-15 mm (20 mm – in cultivation) in diameter.

Tunics – hard, split at the base into a few wide segments of different width, subsplits very rare and minute only in the widest segments.

Tunic neck – 6-10 mm long, bristly, formed by very narrowly based triangular splits of the main tunic.

Basal rings – 2 mm wide, irregularly pronged or almost smooth.

Prophyll – absent.

Cataphylls – 3, the lowest cataphyll brownish, the next one white with a brownish edge, and the upper one white, slightly shaded green at the top.

Leaves – 3-4(5), dark green, developing during blooming and reaching the flower base only at the very end of flowering, 2.5 – 3.5 mm wide, the white stripe very narrow, linear, the surface glabrous or sparsely papillose, lamina margins bent downward, keel margins papillose, lateral channels with 6 well developed ribs and up to 2 poorly developed less conspicuous additional ribs.

Perianth tube – whitish to light yellow, towards the segments striped or suffused greyish to greyish green, rarely in the upper part with pale dirty lilac stripes.

Bract and bracteole – silvery, transparent, subequal or the bracteole longer, usually ending below the base of the flower.

Throat – small, light yellow, with a diffused upper edge, more or less densely papillose, rarely glabrous (observed in 1 individual).

Filaments – 4-**5**-7 mm long, yellow, shaded orange at the top, distinctly, sometimes sparsely, papillose or with minute hairs, sometimes the hairs sparse, very rarely nude.

Anthers – 11-**12.5**-14 mm long, yellow, basal lobes 1.5-2 mm long, parallelly edged, narrowing at the top, with subacute to rounded tips.

Connective – white.

Style – yellow, becoming orange towards the top, very sparsely papillose or even with minute hairs up to the middle or as high as the branching point, stigmatic branches 3-5 mm long, gradually expanding to a fringed stigmatic surface, ending mostly below the tips of the anthers, less often equal with them.

Flower segments – obovate to narrowly obovate, the inside white with a small yellow base, the outside with pale blue striping.

Outer segments – 28-**32**-37 mm long and 10-**12.5**-14 mm wide, white with a pale bluish median stripe reaching the tips of the segments, sometimes solitary, but more often with a few paler lateral stripes, occasionally the space between the stripes tinted pale yellow, rarely pure white, at the base a darker triangular basal blotch with striped midveins, sometimes the blotch is absent.

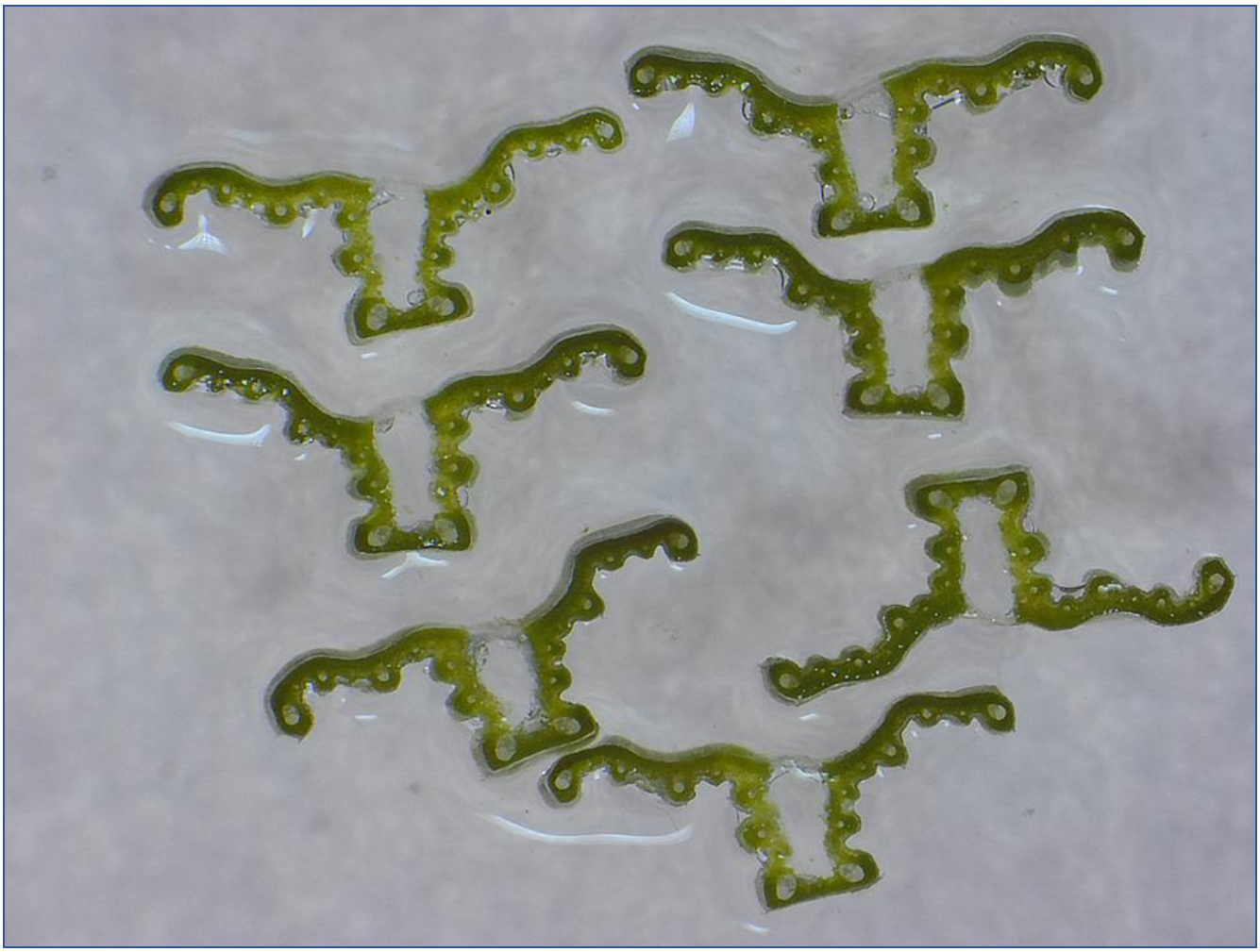
Inner segments – 27-**31.5**-36 mm long and 11-**13.5**-15 mm wide, the outside pure or slightly bluish shaded white with a small bluish or lilac rhombic basal blotch, occasionally the basal blotch in the form of short stripes or completely absent, the inside pure white.

Capsule and seeds – not observed.

2n = ?

Etymology –the species epithet is derived from the Kurdish (Kurmanji) word ‘çîya’ (‘chiai’) meaning ‘a mountain’, ‘mountainous’.

Compared with other species published here *Crocus chiaicus* has the highest number of ribs in leaf lateral channels – 6 well developed and occasionally up to 2 less conspicuous; its flowers are white or very light blue, something resembling *C. dolatyarii* [12] flowers, but flower colour does not change to blue in herbarium (in exsiccatae) and *C. dolatyarii* leaves have only (3)4 ribs in lateral channels; flower throat colour in *C. chiaicus* is distinctly yellow but in *C. dolatyarii* [12] it is white or only slightly shaded yellow.



Crocus chiaicus leaf morphology.

Crocus chiaicus corms.

Crocus chiaicus corm tunics.

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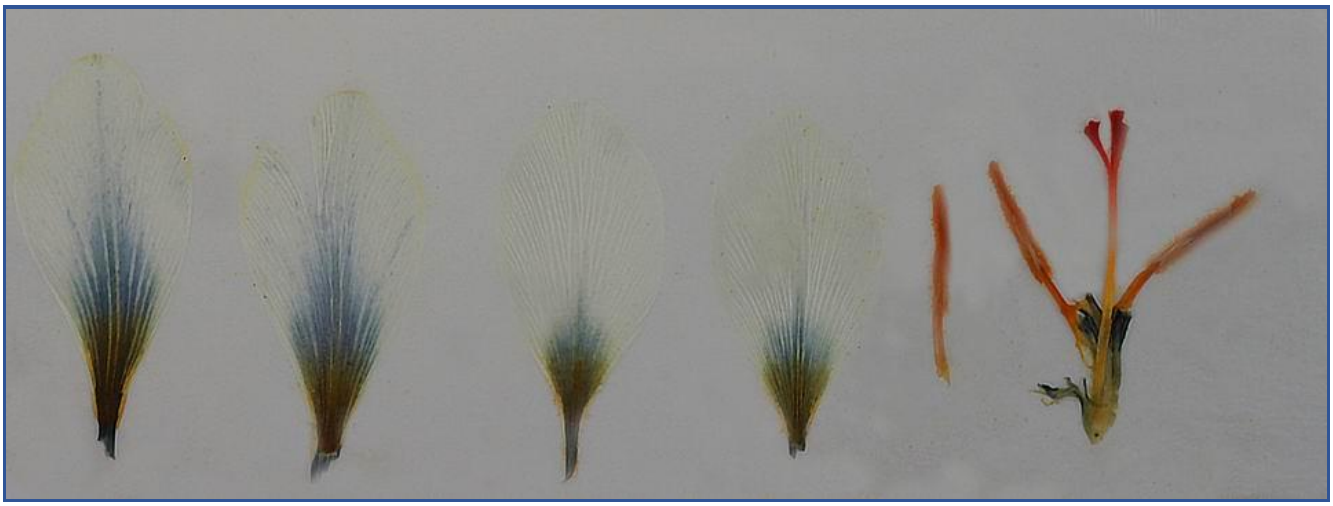
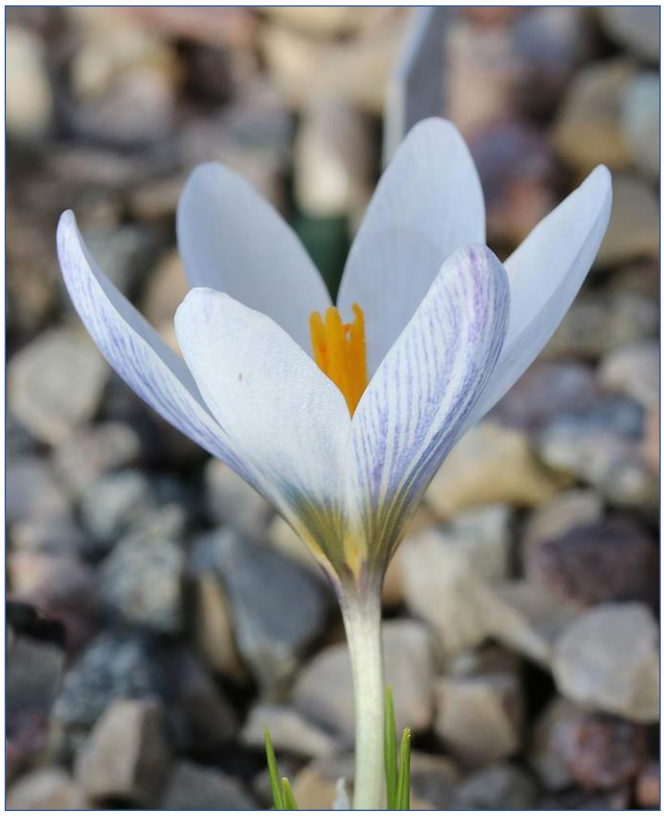
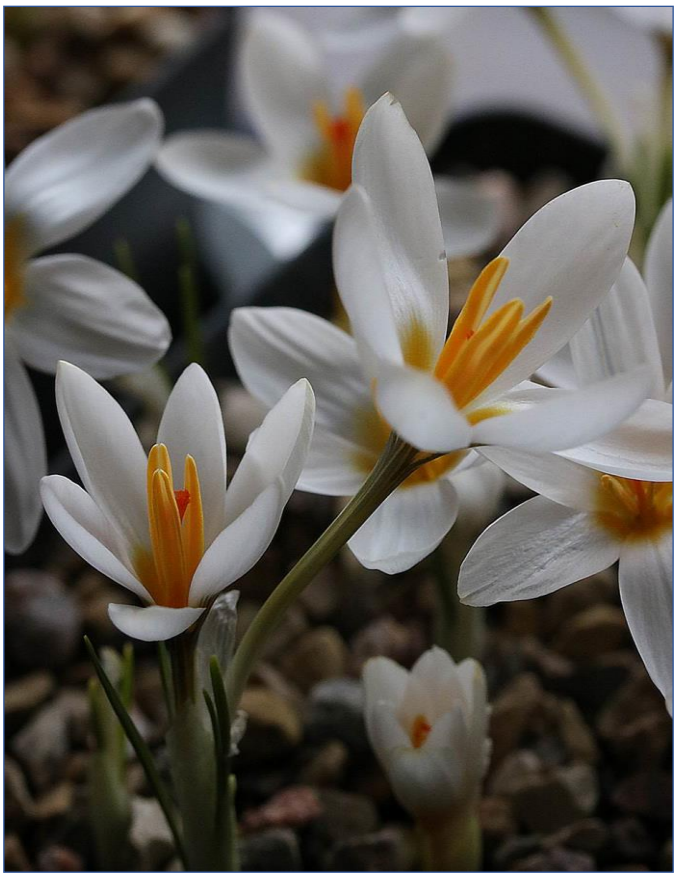


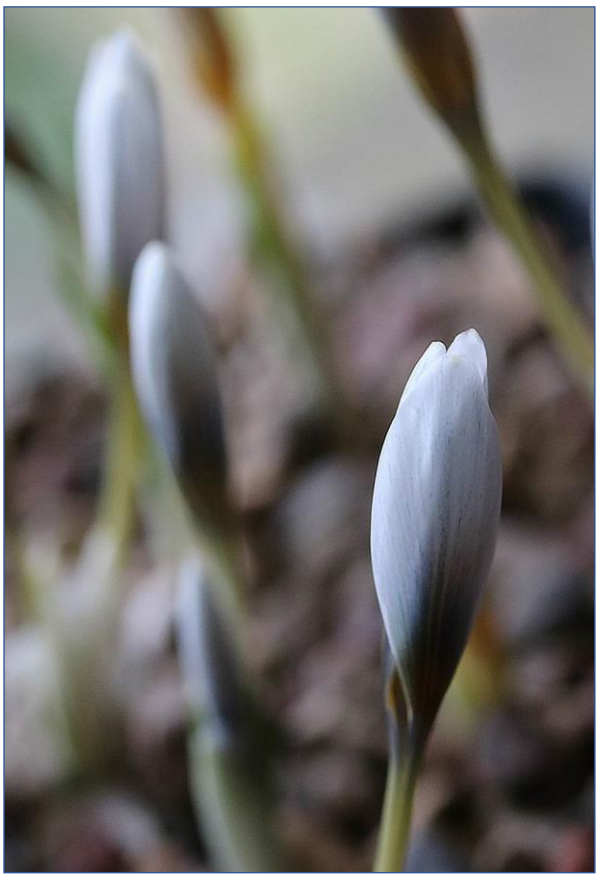
Crocus chiaicus flower details.

Crocus chiaicus holotype herbarium.



Crocus chiaicus





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Crocus chiaicus

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Crocus chionophilus sp. nov. habitat.

Crocus chionophilus Dolatyari & Rukšāns **sp. nov.**

Type: Iran, E Azerbaijan Prov., NEE from Marand, near the pass after Elahrad along the road to Moshirābād. 38°28'N, 46°28'E, alt. 2110 m. Holotypus: IBRC! (Her. No. 3525), Isotypus: RIG! (22IRS-035), leg. A. Dolatyari & J. Rukšāns, 08-04-2022.

Habitat and distribution – in grass on a meadow and between phrygana shrubs at the top of a mountain ridge, near the edge of melting snow, at an altitude of 2110 m.
Flowering time – March – April, fruiting time unknown.
Corm – depressed-globose, up to 10-15 mm in diameter.
Tunics – thin, the outer tunic hard, inner tunics papery; the outer tunic split at the base into 5 mm wide segments with numerous short subsplits, at the top forming a neck; inner tunics split at the top into widely based triangular segments.
Tunic neck – 5-7 mm long, formed by the narrow widely based triangular splits of the outer tunics.

Basal rings – 1-3 mm wide, hard, with a smooth(!) upper edge, the basal plate up to 11 mm in diameter.

Prophyll – absent.

Cataphylls – 3-4, white with darker (light brownish or buff) stripes, the upper cataphyll brownish shaded at the top.

Leaves – emerge during flowering and reach the base of flowers or sometimes are as long as the flowers, 3-5, dark to glaucous green, densely papillose along the edges with minute papillae, the white stripe narrow – 1/7 to 1/6 of the lamina width, lateral channels with downward and inward bent edges and with invariably 4 ridges, sometimes 2 of them less prominent.

Perianth tube – distinctly striped purple on a dirty white ground.

Bract and bracteole – silvery, the bracteole distinctly longer and sometimes even reaches the base of the flowers.

Throat – glabrous, small, very pale yellow, surrounded by a wide yet diffused, starry white edge.

Filaments – glabrous, 4-5 mm long, at the base deep yellow, higher up fading a little and sometimes even creamy at the junction with the anthers.

Anthers – 8-**10**-12 mm long, yellow, with up to 2 mm long basal lobes.

Connective – creamy.

Style – yellow in the throat, becoming deep orange to red at the top, divided into 3-5 mm long branches widened and fringed at the very top, ending around the tips of the anthers – sometimes slightly(!) shorter or longer.

Flower segments – outer segments invariably oblanceolate, inner ones oblanceolate to obovate, the outside distinctly darker striped, the inside whitish to blue.

Outer segments – 26-**28**-30 mm long and 6-**8**-10 mm wide, the outside whitish, buff or light blue with very dark distinct stripes, the middle stripe reaches the tips of the segments, both adjacent stripes shorter with a fine short lateral branching, the inside light to dark blue with somewhat translucent outer stripes.

Inner segments – 22-**24.5**-26 mm long and 7-**9.5**-12 mm wide, shorter and wider than the outer segments, on both sides of similar colour – darker bluish shaded than the outer segments.

Capsule and seeds – capsule positioned at ground level, light buff, around 15 mm long and 6-7 mm wide, with short beak at top; seeds dark reddish purple, slightly elongated, up to 3 mm long and 2.5 mm wide with distinct and large caruncle and well-expressed ridge-like raphe.

2n = ?

Etymology –the name refers to the cold habitat of this species near melting snows.

Easy separable from *Crocus adamii* as it was regarded in Flora Iranica by leaf morphology, having invariably 4 ridges in lateral channels vs. 1-2 ribs in *C. adamii.* Its cataphylls have distinct dark stripes, not observed in *C. adamii* and other species described here.

[According to the observations of Reinhard Fritsch (private letter), at the neighbouring locality (Fritsch 2525, located at a 3.5 km distance at an altitude of 1990 m) some individuals were observed still in bloom in the first week of May, 2011].

Crocus chionophilus - seed capsule and seeds.

Crocus chionophilus holotype herbarium.

Crocus chionophilus flower details.

Crocus chionophilus corm tunics.

Crocus chionophilus leaf morphology.

Crocus chionophilus in nature.

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Crocus chionophilus in cultivation.

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Crocus chionophilus in cultivation.

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Crocus chionophilus in cultivation.

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Sample 22IRS-034 collected near Kagnalagn some 50 km E of the type locality of sample 22IRS-035 on a slope covered with phrygana shrubs at an altitude of 1990 m most likely belongs to another species, its leaves are darker dull green and seem to be wider, although the corm tunics of the plants from both localities seem to be similar. Sample 22IRS-034 was already out of flower, its leaves looked somewhat different (had only 3 ribs in lateral channels and were sparsely but more distinctly papillose) and the few dry flowers found there were blue, so a final decision about their identity will be made later when both samples will be observed in identical conditions in cultivation.

Samples 22IRS-079, 087 and 101 were out of flowers, so only the leaves and corm tunics were characterised; their identity will be checked after they bloom in collections.

Crocus species nova 22IRS-034

---International Rock Gardener---

Crocus species nova 22IRS-034

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Key for spring blooming crocuses with annulate corm tunics growing wild in Iran

(species published by Kerndorf & Pasche [3] and not seen by authors are included following their original descriptions)

1 Flowers yellow

2 Flowers large (up to 30 mm long), anthers pure yellow …….…… ***C. almehensis***

2 Flowers small (up to 15 mm long) anthers with black tips of basal lobes

C. kurdistanicus

1 Flowers white, whitish to blue

3 Throat white ……..…….……... ***C. dolatyarii***

3 Throat lighter or darker yellow

4 Basal rings of corms with toothed edge

5 Lateral channels with 5-6 ribs ……..... ***C. iranicus***

5 Lateral channels with up to 3 ridges

6 Flowers distinctly blue, plant of dry slopes ……... ***C. reinhardii***

6 Flowers whitish, plants of wet bottoms of gullies ……... ***C. gunae***

4 Basal rings with smooth or pronged upper edge, without distinct tooth

7 Throat yellow with distinct although diffused white edge

8 Cataphylls with dark stripes ……..……. ***C. chionophilus***

8 Cataphylls without stripes

9 Throat widely edged white, often shaded greyish, tunics neck formed by narrowly based splits, flowers with strong scent …….. ***C. azarbaijanicus***

9 Throat narrowly edged white, tunics neck formed by widely based splits, flowers weakly scented ……. ***C. marandicus***

7 Throat yellow without distinct white edge

10 Outer corm tunics thin, papery ……..……...…. ***C. inghamii***

10 Outer tunics hard, sometimes even woody

11 Filaments colourless to light yellow ……... ***C. zanjanensis***

11 Filaments yellow to orange yellow

12 Throat and filaments papillose, filaments shaded orange at top

C. chiaicus

12 Throat glabrous

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13 Leaves up to 2 mm wide with 5, rarely 4 ribs in lateral channels ..... ***C. zagrosensis***

13 Leaves up to 4 mm wide, with 3-4 ribs in lateral channels

14 Leaves 4-5, stigmatic branches less than 4 mm long, cataphylls greenish at tips, filaments papillose ***C. pseudoiranicus***

14 Leaves up to 7, stigmatic branches 4-6.5-12 mm long, cataphylls brownish at tips, filaments glabrous ***C. sanandajensis***

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Bibliography

1. Ghaffari S.M., Djavadi S.B. 2007. Chromosome study on *Crocus cancellatus* subsp. *damascenus* from Iran. Iran Journ. Bot. 13 (1): 1-3.
2. Harpke D., Kerndorff, H., Pasche, E., & Peruzzi L. 2016. Neotypification of the name *Crocus biflorus* Mill. (Iridaceae) and its consequences in the taxonomy of the genus. Phytotaxa 260 (2): 131-143.
3. Kerndorff H., Pasche E. & Harpke D. 2017. *Crocus adamii* Gay (Liliiflorae, Iridaceae) and some of its relatives in Iran. Stapfia 107: 3–10.
4. Kerndorff H., Pasche E. & Harpke D. 2015. The Genus *Crocus* (Liliiflorae, Iridaceae): Lifecycle, Morphology, Phenotypic Characteristics, and Taxonomical Relevant Parameters. Stapfia 103: 27–65.
5. Maroofi, H. 2002. Notes on the flora of Kurdistan province, Iran. The Iranian Journal of Botany. Vol. 9: 233--234.
6. Mathew, B. 1982. The Crocus. A Revision of the Genus *Crocus* (Iridaceae). London: B.T. Batsford Ltd. 224 pp.
7. Rukšāns J. 2012: Seven new crocuses from the Balkans and Turkey. – Alpine Gardener 81: 188–193 & Supplement 15 p.

8. Rukšāns J. 2014. *Crocus danfordiae* Maw and *C. chrysanthus* (Herbert) Herbert (*Iridaceae*) and some of their allies in Turkey and Iran. International Rock Gardener - Online Journal. 52: 2-31.
9. Rukšāns J. 2014. The Genus *Crocus* (Iridaceae) in Iran – three new species from the so-called "*Crocus biflorus*" aggregate. Int. Rock Gard. - Online Journal. 61: 2-26.
10. Rukšāns J. 2017. The World of Crocuses. The Latvian Academy of Sciences, Riga, 568 p.
11. Rukšāns J. 2017. *Crocus inghamii* Rukšāns – A New Crocus Species from NW Iran. Int. Rock Gard. - Online Journal. 89: 11.
12. Rukšāns J. 2022. *Crocus dolatyarii* – a new species from W Iran. Int. Rock Gard. – Online Journal. 149: 70-90.
13. Wendelbo P., Mathew B. 1975. Iridaceae. Flora Iranica, No. 112. Ed. K. H. Rechinger. Austria. Graz: Akademische Druck- u. Verlagsanstalt.

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