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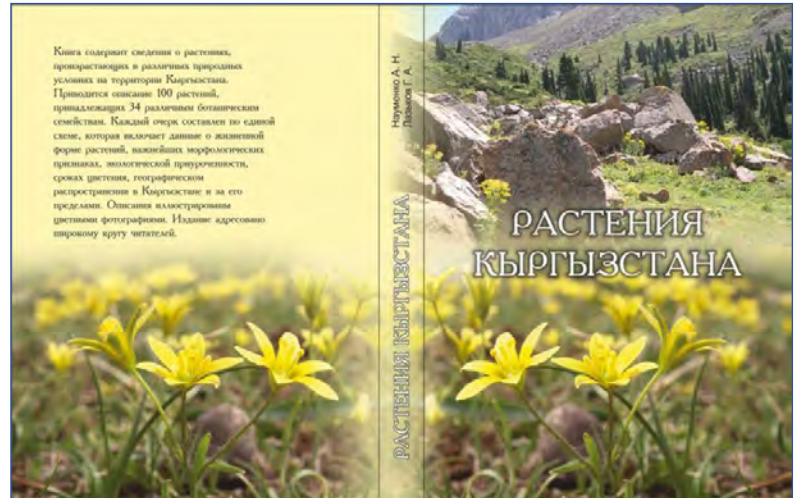


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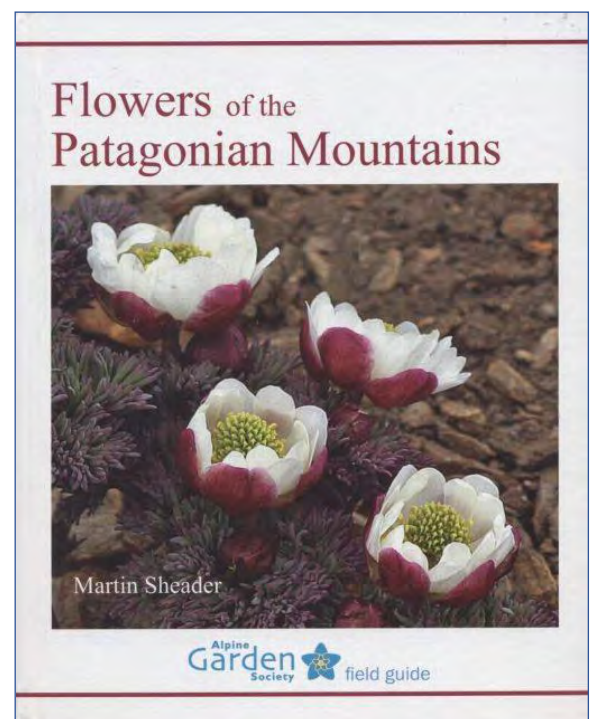
In IRG 140 a new fritillary species from the Fergana Valley, southern Kyrgyzstan, *Fritillaria rugilosa* (subgen. *Rhinopetalum*; Liliaceae) is described by Alexander Naumenko and Dimitri Zubov. Dr Zubov, of the State Institute for Genetic and Regenerative Medicine, National Academy of Medical Sciences of Ukraine; Kyiv, Ukraine, is already familiar to IRG readers for his plant articles and species descriptions – he is also known for his medical science papers, of course.

Alexander Naumenko opened the [Nova Zahrada nursery](#) in Mořice, in Central Moravia (Czech Republic) in the spring of 2014. He had begun to grow his plant collection fifteen years earlier, in Kyrgyzstan, in Central Asia. In 2012, Alexander wrote, with Dr. Sci. Georgy A. Lazkov, "Растения Кыргызстана" ("Plants of Kyrgyzstan") It contains images of 100 native plants of Kyrgyzstan. Each plant has its Latin name given and a short botanical description in Russian.



The second article this month is Patagonian Verbenas - Junellia (part 1) by Martin Sheader, a marine biologist from Southampton, who is known for a great interest in all plants, particularly those from South America, as well as for his writing, talks and show exhibits. Dr Sheader has travelled extensively in this part of South America and his book 'Flowers of the Patagonian Mountains' is the most comprehensive photographic guide yet published to the area's diverse and fascinating flora.

In a foreword to the book, Professor Sir Ghilleen Prance FRS, VMH writes enthusiastically about the book, commenting that it is '...a thoroughly researched botanical field guide based on a huge amount of experience in the field by the authors. Each photograph is accompanied by accurate botanical descriptions and, importantly, by accurate and up-to-date scientific names for each species.'



Cover image: *Junellia tridactylites*, showing the three-lobed leaves. Photo Martin Sheader.

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--- Species Description ---

***Fritillaria rugilosa* (subgen. *Rhinopetalum*; Liliaceae): a new species from the Fergana Valley, southern Kyrgyzstan**

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Summary. *Fritillaria rugilosa* (Liliaceae), a new fritillary species endemic to the Fergana Valley (Jalal-Abad Region, southern Kyrgyzstan), is described and illustrated. Morphological differences between the new species and other possibly related taxa of the subgen. *Rhinopetalum* (*F. stenantha*, *F. gibbosa*, and *F. karelinii*) are discussed. Photographs (habitat and morphology) and distribution maps are provided.

Key words: geophyte, fritillary, Kyrgyz flora.

Introduction

The Fergana Valley is located in three countries - Kyrgyzstan, Uzbekistan and Tajikistan, and is known for a great flora biodiversity, namely a significant number of monocots, many of which are local endemics. According to Karimov & Naralieva [4], 85 species of the genus *Allium* are known in the Fergana Valley, 34 *Gagea* species, 21 *Tulipa* species, 20 *Iris* species, 6 *Fritillaria* species.

The Fergana Valley is located in the southwestern part of the vast Tien Shan mountain system, which the glaciers and snow feed the Naryn and Kara Darya Rivers. Both rivers go out to the valley at its beginning in the east and, merging, they form the Syr Darya River. The latter flows in the direction from north-east to south-west and divides Fergana into two asymmetrical parts, the southern part is larger. The length of the valley is about 250-300 km. The width of the valley reaches 130 km and narrows in the west to 5-10 km. From the east, the valley is bordered by the Fergana Range, from the south by the Alay and Turkestan Ranges, from the north by the Chatkal and Kuramin Ranges.

Quaternary deposits (pebble, crushed stone, sand, loam, sandy loam, clay) compose the plains and fill intermontane, post- and inter-adyr depressions. The surface of the Fergana Valley, especially in its central part, is flat and represents the ancient terraces of the Syr Darya River (up to four terraces) and numerous alluvial cones.



Figure 1.1: *Fritillaria rugillosa* type locality, Jalal-Abad Region, Kyrgyzstan, March 2021 - a landscape of the red clay outcrops (photo credit – A. Naumenko)

The climate of the Fergana Valley is dry, harsh continental and characterized by the long-term frost-free period. Average monthly temperatures in July vary from +23°C in the west to +28°C in the central parts of the valley, maximum temperatures reach +43°C. Average January temperatures in the west are -0.9°C, in the east -2.5°C. Winters are characterized by unstable weather, the minimum temperatures can drop to -25°C, but on some winter days, warm weather is observed. The snow cover is short-lived. Annual precipitation is about 150 mm, in the foothills – 250-300 mm. The foothill zone of the eastern part of the valley, where new fritillaria is distributed, has the average annual precipitation level typical for a weak arid zone (e.g., 502 mm in Jalal-Abad area), while most of the valley has a harsh arid climate with periodic frosts down to -25°C [18].

It should be noted that this region is still insufficiently studied, which is evidenced by the fact that only in the last two decades in the Fergana Valley new species of *Allium*, *Tulipa*, *Iris*, *Fritillaria* have been simply identified by distinct morphological characters.

As for genus *Fritillaria* members, we accept the following species for the Fergana Valley (Kyrgyzstan and Uzbekistan), actually (incl. sp. nova) [cfr. 4-11, 16]:

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Fritillaria eduardii A.Regel ex Regel (subgen. *Petilium*)

Fritillaria ferganensis Losinsk. (subgen. *Fritillaria*)

Fritillaria karelinii Regel (subgen. *Rhinopetalum*)

Fritillaria rugilosa Naumenko & Zubov (subgen. *Rhinopetalum*)

Fritillaria sewerzowii Regel (subgen. *Korolkowia*)

Fritillaria walujewii Regel (subgen. *Fritillaria*)

Considering fritillaries, the Martin Rix's classification [13] is most relevant for a moment, and consists of eight *Fritillaria* subgenera: *Fritillaria*, *Rhinopetalum*, *Theresia*, *Petilium*, *Liliorhiza*, *Korolkowia*, *Davidii*, and *Japonica*.

Currently, subgenus *Rhinopetalum* (Fisch. ex Alexander) Baker. encloses seven species, including a new species described here from Kyrgyzstan. Often in the wild there are fritillaries of morphologically indefinite intermediate forms or races, which, possibly, might be the new, still undescribed species. That is why further molecular-genetic studies of this cherished and exciting subgenus are required in order to realize its phylogenetic tree and delimitation of its controversial geographical races or even new species yet to be described.



Figure 1.2: *Fritillaria rugilosa* in type locality – Jalal-Abad Region, Kyrgyzstan, March 2021 - Flowering plants in a habitat of the ephemeral steppes (photo credit – A. Naumenko).



Figure 1.3: *Fritillaria rugilosa* in type locality – Jalal-Abad Region, Kyrgyzstan, March 2021 - Flowering plants in a habitat of the ephemeral steppes (photo credit – A. Naumenko).



Figure 1.4: *Fritillaria rugilosa* in type locality – Jalal-Abad Region, Kyrgyzstan, March 2021 - Flowering plants in a habitat of the ephemeral steppes (photo credit – A. Naumenko).



Figure 1.5: *Fritillaria rugilosa* in type locality – Jalal-Abad Region, Kyrgyzstan, March 2021 - Flowering plants in a habitat of the ephemeral steppes (photo credit – A. Naumenko).

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Figure 1.6: *Fritillaria rugilosa* in type locality – Jalal-Abad Region, Kyrgyzstan, March 2021 - Flowering plants in a habitat of the ephemeral steppes (photo credit – A. Naumenko).

Figure 1.7: *Fritillaria rugilosa* in type locality – Osh Region, Kyrgyzstan, March 2014 - Flowering plants in a habitat of the ephemeral steppes (photo credit – A. Naumenko).



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The main area of distribution of rhinopetalums lies within the desert and arid zones of Central Asia, S Transcaucasia, SW Asia (Iranian Plateau), and Junggar Basin (e.g., in Armenia, Iran, Turkmenistan, Kazakhstan, Tajikistan, Kyrgyzstan, Uzbekistan, Afghanistan, Pakistan, and China) [4-12, 15, 16]:

Fritillaria ariana (Losinsk. & Vved.) Rix (Turkmenistan, N Afghanistan: Badghis, NE Iran)

Fritillaria baisunensis Ruksans (Uzbekistan: Baisun)

Fritillaria bucharica Regel (Afghanistan, Tajikistan, Uzbekistan)

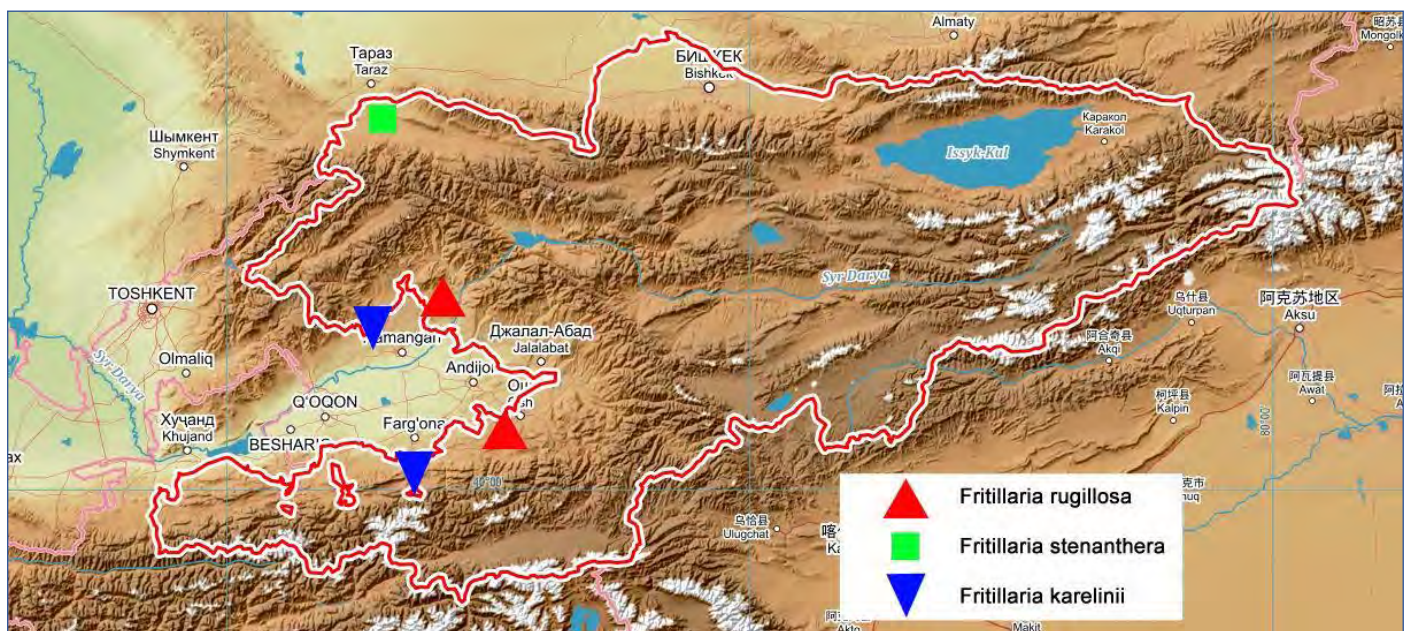
Fritillaria gibbosa Boiss. (Afghanistan, Iran, Pakistan: Balochistan, Armenia: Ararat, Turkmenistan)

Fritillaria karelinii (Fisch. ex D.Don) Baker (Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan, China: Xinjiang)

Fritillaria rugilosa Naumenko & Zubov (Kyrgyzstan: The Fergana Valley, possibly Uzbekistan)

Fritillaria stenantha (Regel) Regel (Kazakhstan, Kyrgyzstan: The Talas Valley, Tajikistan, Uzbekistan; see Key & Figs. 2-4 & 7).

Thereby in Kyrgyzstan three fritillary species from subgen. *Rhinopetalum* are distributed for today: *F. karelinii* (northern and southern parts of the Fergana Valley), *F. rugilosa* (eastern part of the Fergana Valley) and *F. stenantha* (western part of the Talas Valley; see Map 1).



Map 1 - The distribution map of three fritillary species from subgen. *Rhinopetalum* in Kyrgyzstan.

Materials and Methods

Field studies for *Fritillaria rugilosa* were undertaken in Kyrgyzstan in 2014-2021 (Naumenko, Zenin, *pers. observ.*), and seed grown living material in cultivation (Kyrgyzstan, Ukraine, Czech Republic) was examined by us between 2017 and 2021. Herbarium specimens of other subgen. *Rhinopetalum* species were examined at the herbaria of FRU and OL (abbreviations after [2]).

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Measurements, colours, and other details are based on living material, spirit and herbarium specimens and data derived from field notes. Morphological and anatomical examinations were made using a stereo microscope Stemi 2000-C (Carl Zeiss, Germany). Morphological terminology follows [1]. The distribution maps (Maps 1 & 2) were plotted and produced using specimens and recorded coordinates, verified using [17]. The preliminary conservation status of *F. rugilosa* was not evaluated against the Red List Criteria [3] due to the insufficient data of the new species full-range distribution.

***Fritillaria rugilosa* Naumenko & Zubov sp. nov.** (Figs. 1.2-1.7, 2, 3, 5, 6 & 7.10).

Type: Kyrgyzstan, Jalal-Abad Region, to the west of city Tash-Kumyr, north-eastern part of the Fergana Valley; low mountains, red clay outcrops, c. 1000 m elevation; fl. 27.03.2021, coll. Naumenko & Zenin s.n. (holotypus OL 38056!)

Bulb tunicate, globose, whitish, two-scaled, 2-2.5(-3) cm in diam.

Stem stiff, green, slightly brownish at base or completely brownish, papillose, 5-10(-15) cm long.

Leaves cauline, 4-6, alternate, green, with plain or slightly undulate margins, two basal leaves much bigger, broadly lanceolate, acuminate, 3-3.5 cm × 7-8 cm; middle and upper leaves narrowly lanceolate to linear, papillose, acuminate, 0.8-0.9 × 5.5-6 cm.

Bract leaves in pairs at the base of each pedicel, linear, green, papillose, narrowly lanceolate to linear, acuminate, with plain or slightly undulate margins, 0.4-0.5 × 4-4.5 cm.

Flowers 1-3(-7), actinomorphic, sideways directed at flowering, nearly flat, with 6 more-less equal nectary horns abaxially, without pinching between nectary horns and perianth segments, 3-4 cm in diam. *Pedicels* stiff, brownish, papillose, 1.5-1.8 cm long. Perianth segments 6, in two whorls, bright pink, often brighter reddish-pink by veins, so that flower looks striped, or bright pink moire. *Outer perianth segments* 3, c. 1.1 × 2 cm, lanceolate, acuminate, reflexed and slightly pubescent at apex, nectary horns dark brown, protrude abaxially on 3-4 mm, basal adaxial nectary field (c. ¼ of a segment length) with fossa, yellowish-green with wine-red tracery distally; nectary forms adaxially non-closed hollow tube 4-5 mm long with a central yellowish-green papillose groove at a segment base. *Inner perianth segments* 3, c. 1.2 × 3 cm, lanceolate, reflexed and notched at apex, nectaries protrude abaxially on 3-4 mm, basal adaxial nectary field (c. ¼ of a segment length) with fossa, yellowish-green with wine-red tracery distally, c. 6-7 × 8 mm, segment apex slightly pubescent. *Androecium*. *Stamens* 6, in two trimerous whorls, diplostemonous; *filaments* 6, violet or purple, pubescent by 2/3 at a base, white and glabrous in upper part, or fully pubescent along the entire length, c. 9 mm long (c. 1/2 to 1/3 shorter after dehiscence); *anthers* 6, violet, linear, with four locules per anther, introrse, basifixed, 7-8 mm long; *connective* undeveloped, violet, c. 2 mm long; *pollen* golden yellow, globose.

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Gynoecium (ovary and receptacle) syncarpous, tricarpellate; ovary superior, green, elongated, ± triangular with cut corners in cross section, each carpel ends by two prominent horns at apex, c. 5-6 mm long; placentation axile; pistil filiform, style violet, glabrous, c. 7-8 mm long; stigma barely trilobed, white, papillose.

Capsule c. 2.5 × 2.7 cm; with dried perianth remnants at the base; tricarpelate, short-cylindrical, loculicidal and six-angled, winged, reddish in upper part and by wings; wings horned (6-toothed) at apex, serrated along the entire length.

Seeds flattened with a narrow marginal wing, ± ovoid, 0.5 × 0.9 cm, reddish-brown, in two rows per chamber (carpel), the seed coat made out of both integuments, but the testa is thin and the endosperm lacks starch, the embryo is small and visible.

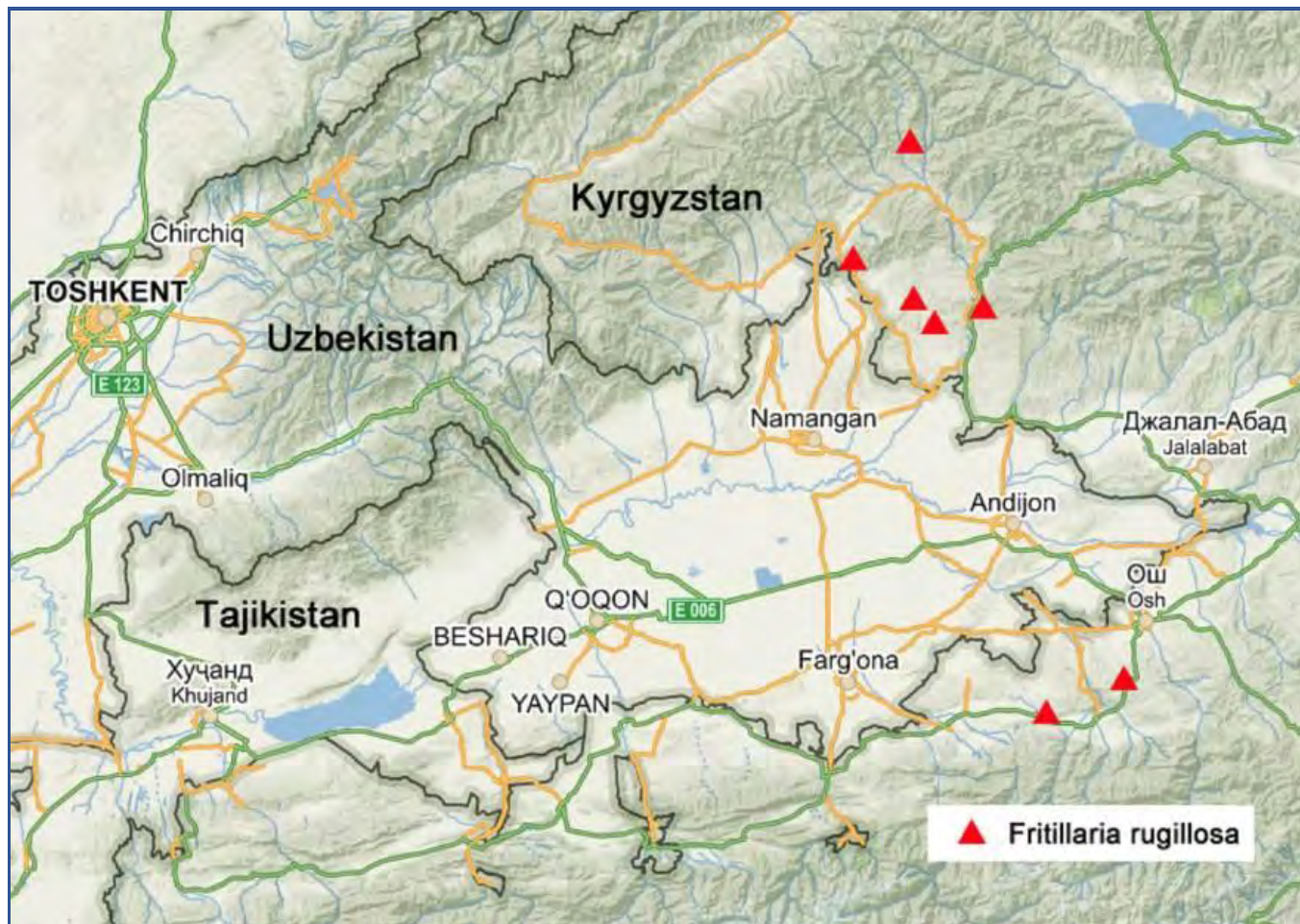
RECOGNITION. Possibly related to *F. stenantha* but differs by an open/flat, wide-wheel-shaped perianth, sideways directed at flowering; perianth segments without a pronounced pinch between the nectary horn and the bend of a segment; dark, violet or purple filaments, pubescent by 2/3 at a base, white and glabrous in upper part, or sometimes fully pubescent along the entire length (vs narrowly conical perianth with prominent pinch between the nectary horn and the bend of a segment; greenish or pinkish filaments, always pubescent along the entire length in *F. stenantha*).

Possibly related to *F. gibbosa* but differs by two oval basal leaves; cauline and bract leaves with plain or slightly undulate margins; perianth segments striped by veins pattern; number of flowers 2-7; actinomorphic perianth due to the equally developed nectary horns of all segments (vs two narrowly lanceolate channelled basal leaves with markedly undulated margins; markedly twisted cauline and bract leaves; speckled pattern of perianth segments; number of flowers 3-17; zygomorphic perianth due to a more developed nectary horn of the upper segment in *F. gibbosa*).

Possibly related to *F. karelinii* but differs by bright green papillose foliage; perianth segments striped by veins; actinomorphic perianth due to equally developed nectary horns of all segments; winged capsule, reddish in upper part and by wings, with 6 prominent teeth, not striped (vs dark green, greyish, highly papillose foliage; c. 1/3 smaller perianth segments with highly speckled pattern; zygomorphic perianth due to only one nectary strongly developed on the uppermost outer perianth segment; much smaller c. 1/2 by size wingless capsule with 6 small teeth and parallel anthocyanin stripes in *F. karelinii*).

DISTRIBUTION. Central Asia: Kyrgyzstan, eastern part of the Fergana Valley: south-eastern foothills of Alay Range to north-eastern foothills of Fergana Range, Jalal-Abad and Osh Regions; low mountains, red clay outcrops, c. 1000 m elevation; possibly, a local endemic of eastern part of the Fergana Valley. Also with a high probability it can be distributed in Uzbekistan part of the Fergana Valley (see Map 2).

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Map 2 -The distribution map of *Fritillaria rugilosa* in Kyrgyzstan.

SPECIMENS EXAMINED. [Kyrgyzstan, Jalal-Abad], to the west of city of Tash-Kumyr, north-eastern part of the Fergana Valley; low mountains, red clay outcrops, c. 1000 m elevation; fl. 27.03.2021, coll. Naumenko & Zenin s.n. (holotypus OL 38056!). The exact locality of *F. rugilosa* has not been documented here for fear of unlawful plant collecting.

HABITAT. Described from the ephemeral steppes of the southern foothills of the Bozbu-Too Ridge at c. 1000 m elevation; growing in red clay deposits. Observed phytocenosis indicators included the woody species *Prunus tianshanica* (Pojark.) S.Shi, *Zygophyllum atriplicoides* Fisch.& C.A. Mey., and the herbaceous species – *Eremurus tianschanicus* Pazij & Vved. ex Golosk., *Colchicum luteum* Baker, *Tulipa turkestanica* (Regel) Regel, *Gagea* sp., *Euphorbia ferganensis* B.Fedtsch. ex O.Fedtsch. & B.Fedtsch., *Anemone* sp., etc. Plants in observed population were well developed, often bearing up to 5-7 flowers. Mesophyte, argillophyte (Fig. 1).

PHENOLOGY. Flowering (wild and cultivated): March-April; fruiting (wild and cultivated): May-June.

ETYMOLOGY. Name of the specific epithet '*rugilosa*' compiled of two Latin words: *rubra* = red and *argillosa* = clayey, that means the newly described fritillaria predominantly grows in red clay outcrops.

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Figure 2: The flowers of fritillary species from subgen. *Rhinopetalum*; cultivated in Kyiv Region, Ukraine: a, b – abaxial view; c – adaxial view (photo credit – D. Zubov):

1. *F. stenantha*, Turkistan, Kazakhstan
2. *F. bucharica*, Darwaz, Tajikistan
3. *F. karelinii*, Mangystau, Kazakhstan
4. *F. gibbosa*, Bojnurd, Iran
5. *F. rugilosa*, Jalal-Abad, Kyrgyzstan



2a – abaxial view



2b – abaxial view



2c – adaxial view

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Figure 3: The bulbs of fritillary species from subgen. *Rhinopetalum*; cultivated in Kyiv Region, Ukraine (photo credit – D. Zubov):

1. *F. ariana*, Turkmenistan
2. *F. baisunensis*, Baisun, Uzbekistan
3. *F. bucharica*, Norak, Tajikistan
4. *F. gibbosa*, Bojnurd, Iran
5. *F. karelinii*, Mangystau, Kazakhstan
6. *F. rugilosa*, Osh, Kyrgyzstan
7. *F. stenanthera*, Turkistan, Kazakhstan.



Figure 4: The seeds of fritillary species from subgen. *Rhinopetalum*; cultivated in Kyiv Region, Ukraine (photo credit – D. Zubov):

1. *F. bucharica*, Darwaz, Tajikistan
2. *F. stenanthera*, Turkistan, Kazakhstan
3. *F. karelinii*, Mangystau, Kazakhstan
4. *F. rugilosa*, Osh, Kyrgyzstan
5. *F. ariana*, Turkmenistan
6. *F. gibbosa*, Ararat, Armenia.



Figure 5: *Fritillaria rugilosa* seeds, Osh, Kyrgyzstan; cultivated in Kyiv Region, Ukraine (photo credit – D. Zubov).



Figure 6: *Fritillaria rugilosa* seed capsule, Osh, Kyrgyzstan; cultivated in Bishkek, Kyrgyzstan (photo credit – S. Zenin).

Discussion

On the territory of Kyrgyzstan (for objective reasons, field works were carried out only on the territory of Kyrgyzstan), until recently, two subgen. *Rhinopetalum* species were known, - *F. karelinii* and *F. stenantha* [4, 16].

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For a long time, the new fritillaria species was fully identified as *F. stenantha*, especially by herbarium specimens, but a set of clear morphological characters makes *F. rugilosa* a completely separate taxon that deserves description as a new species. Also, when cultivated, both species clearly differ from each other at flowering. *Fritillaria stenantha* is indicated in vol. 3 of Flora of Kyrgyz SSR for Alai (Pamiro-Alay) and Chatkal (Western Tien Shan) areas [9]. In Flora URSS [5] and Keys to plants of Central Asia [6], it is also indicated for the Pamiro-Alay and Tien Shan. However, according to the latest observations [Lazkov, 2016; Zenin, 2017; Naumenko & Zenin, 2021; *pers. observ.*], *F. stenantha* (*sensu auct.*), corresponding to the typical plants described from the foothills of Karatau, on the territory of Kyrgyzstan occurs only in the Western Tien Shan: the western part of the Ichkeluu-Too Ridge in the Talas Valley (Fig. 7.1). It should be clarified here that in the concept of the *F. stenantha* species (in full accordance to Rix description and drawing [12]) we introduce the character of the constriction of the perianth. It means that due to the well-developed equal abaxial nectary protrusions and the bend of a segment sharply reflexed, thus a clearly pronounced constriction/pinch is obtained in the silhouette of a perianth. This morphological feature is characteristic only for *F. stenantha* in the entire subgen. *Rhinopetalum* (Figs. 7.1-7.3).

Figure 7: The variability of fritillary species from subgen. *Rhinopetalum*:



Figure 7.1: *F. stenantha*, the Talas Valley, in the wild (photo credit – G. Lazkov)



Figure 7.2: *F. stenantha*, Ikhnachsay, Uzbekistan, cultivated in Kyiv Region, Ukraine
(photo credit – D. Zubov)



Figure 7.3: *F. stenantha*, Kazakhstan, cultivated in Kyiv Region, Ukraine (photo credit – D. Zubov)

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The possible finds of *F. stenantha* in the Fergana Valley and its mountainous surroundings in Kyrgyzstan can be judged by the presence of herbarium specimens (no numbers) under the name of *Rhinopetalum stenanthum* Regel in the Herbarium of the Institute for Biology of National Academy of Sciences of Kyrgyzstan (FRU). According to Lazkov, there are four samples in that herbarium [Lazkov, 2021; *pers. observ.*]. Considering the herbarium labels of the samples, two of them were taken from the same population, which is located several kilometres to south of the *F. rugilosa* sp. nova population found in 2021 [Naumenko & Zenin 2021, *pers. observ.*]. One sample was also taken from the population of *F. rugilosa* sp. nova, considering the photos taken by Lazkov [Lazkov, 2021; *pers. observ.*]. The fourth sample taken from the northern shore of the Toktogul Reservoir is of interest, as it is located far from the known ranges of *F. stenantha* and *F. rugilosa* sp. nova. It seems to be that true *F. stenantha* [12] isn't distributed in the Fergana Valley and its vicinities (see Map 1).

According to multiple field observations, *F. sewerzowii* occurs also in that region [Lazkov, 2016; Zenin, 2017; Naumenko & Zenin, 2021; *pers. observ.*].



Figure 7.4: *F. baisunensis*, Baisun, Uzbekistan, cultivated at Janis Ruksans nursery, Latvia
(photo credit – D. Zubov)

Figure 7.5:

F. bucharica, Norak (left)
& Darwaz (right) plants,
Tajikistan, cultivated in
Kyiv Region, Ukraine
(photo credit – D. Zubov)



Figure 7.6: *F. karelinii*, Batken Region, Kyrgyzstan, in
the wild (photo credit – G. Lazkov)

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Figure 7.7: *F. karelinii*, Batken Region, Kyrgyzstan, in the wild (photo credit – G. Lazkov)

Fritillaria karelinii for the territory of Kyrgyzstan was first mentioned in the Flora Cadaster of Kyrgyzstan [8] for the Western Tien Shan. According to Lazkov, herbarium specimens are absent in the FRU. According to the field observations [Lazkov, 2021; Zenin, 2017; Naumenko &



Zenin, 2021; *pers. observ.*], populations of *F. karelinii* in Kyrgyzstan are known for the Fergana Valley (within its northern and southern parts; see Figs. 7.6 & 7.7). It is in both cases to the west of the range of *F. rugilosa* sp. nova. Interesting, that mixed populations of *F. rugilosa*, *F. karelinii* or *F. stananthera* in any combination were never observed.



Figure 7.8: *F. ariana*, *F. gibbosa*, *F. karelinii* & *F. rugilosa* (left to right), cultivated in Kyiv Region, Ukraine (photo credit – D. Zubov)



Figure 7.9: *F. ariana*, *F. gibbosa*, *F. karelinii* & *F. rugilosa* (left to right), cultivated in Kyiv Region, Ukraine (photo credit – D. Zubov)



Figure 7.10: *F. rugilosa*, Osh, Kyrgyzstan, cultivated in Kyiv Region, Ukraine
(photo credit – D. Zubov)



Figure 7.11: *F. karelinii*, Mangystau, Kazakhstan, cultivated in Kyiv Region, Ukraine (photo credit – D. Zubov)

Fritillaria rugilosa was initially found by Aleksander Naumenko in April 2014 in the low-mountain belt of the northern slope of the Alai Ridge of the Pamir-Alai mountain system in the Osh Region of Kyrgyzstan. The found population consists of single plants located several metres or tens of metres from each other; only one-flowered individuals were found in that population. The population itself is located at an altitude of about 1500 m above sea level on a gentle slope composed of red clay in a community with herbaceous *Festuca sp.*, *Gagea sp.*, *Euphorbia ferganensis*, *E. rapulum* Kar. & Kir., and woody *Zygophyllum atriplicoides*. Obviously, the population is in a depressed state meantime due to intensive grazing.

In 2017, Sergei Zenin found a population of this new fritillaria to the west of the city of Tash-Kumyr in the Jalal-Abad Region in the foothills to the south of the Bozbu-Too Ridge among red clay deposits in the community with woody *Prunus tianshanica*, *Z. atriplicoides* and the herbaceous species – *Eremurus tianschanicus*, *Colchicum luteum*, *Tulipa turkestanica*, *Gagea sp.*, *E. ferganensis*, *Anemone sp.*, etc. Plants in populations were well developed, often bearing up to 5-7 flowers, and they didn't look depressed (Fig. 1).

Currently, on the territory of Kyrgyzstan, two populations of *F. rugilosa* are known in the southern part of the Fergana Valley and at least 5 populations within its northern part. In most cases,

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the populations are located on red clay outcrops in the low-mountain and foothill zones. Two populations, the westernmost and the northernmost, grow on gravelly rocky slopes. The elevation at which the populations are found, ranges from 900 to 1500 m above sea level (Map 2).

The preliminary conservation status of *F. rugillosa* was not assessed due to the insufficient data but it could be informally evaluated between *Vulnerable* and *Endangered* [3] by known number of its locations in the wild.

Key to the identification of *Fritillaria* species from the subgen. *Rhinopetalum*

1. ☯ Perianth actinomorphic due to equally developed nectary horns of all segments see 2
 ☯ Perianth zygomorphic due to a more developed nectary horn of the upper segment; flower colour of varying degree of pink, reddish, lilac, purplish-crimson, rarely greyish or apricot, speckled or not see 3

2. ☯ Perianth white, cream, greyish, or greenish see 4
 ☯ Perianth of varying degrees of pink, reddish, lilac, very rarely apricot or white, never speckled see 5

3. ☯ Capsule wingless; perianth highly speckled ***F. karelinii***
 ☯ Winged capsule; perianth speckled or not see 6

4. ☯ Anthers yellow or greenish-yellow; perianth never speckled ***F. bucharica***
 ☯ Anthers blackish-purple; perianth minutely speckled, or moire, or not speckled at all ***F. baisunensis***

5. ☯ Perianth shape narrowly conical with prominent pinch between the nectary horn and the bend of a segment; filaments greenish or pinkish, always pubescent along the entire length ***F. stenantha***
 ☯ Perianth flat, wide-wheel-shaped, distinctly side-directed at flowering; perianth segments without a pronounced pinch between the nectary horn and the bend of a segment; filaments dark, violet, sometimes purple, pubescent by 2/3 at a base, white ***F. rugillosa***

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and glabrous in upper part, or sometimes fully pubescent along the entire length

sp. nova

6. ☉ Plants distinctly pubescent; perianth always speckled

F. gibbosa

☉ Plants mainly glabrous; perianth never speckled

F. ariana

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Figure 7.12: *F. ariana*, Turkmenistan (left) & *F. gibbosa*, Bojnurd, Iran (right) cultivated in Kyiv Region, Ukraine (photo credit – D. Zubov)



Figure 8: *Fritillaria rugillosa*: OL 38056 Holotype sheet deposited at the Herbarium of the Department of Botany of Palacký University, Olomouc (Czech Republic).

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--- Overview of a South American Genus ---

PATAGONIAN VERBENAS: Martin Sheader

Part 1 – *Junellia*

Patagonia is the wild and remote region at the southern tip of South America, including the southern parts of Argentina to the east of the Andes and Chile to the west. Argentina's four southernmost mainland provinces are included in this region: moving north to south – Neuquén, Río Negro, Chubut and Santa Cruz, as well as Tierra del Fuego. The region comprises a wide range of habitats including mountains, permanent ice fields, glaciers, lakes, mesetas (plateaus), and desert-like steppe. With winds predominantly from the west, rainfall is higher to the west of the Andes, reducing as we move eastwards away from the mountains. Wind speeds, especially in the far south, are often high. Winters can be cold and summers usually cool, though periods of warm weather during the summer months are not unusual, especially in the north of the region.



Fig. 1 – *J. azorelloides* showing mat growth form.

Junellias are predominantly (though not exclusively) found in dry or arid habitats – the Steppe and Monte ecoregions. The Patagonian Steppe is the eighth largest desert in the world, extending from the Andes to the Atlantic coast. The central parts of the steppe are dominated by shrubby and herbaceous plants with an increase in grasses to the west, where precipitation is higher.

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Topographically these deserts are formed of alternating mesetas and massifs dissected by river valleys. In the western steppe, glacial lakes extend from the mountains and ice fields, with temperate forests along valleys. To the north the Steppe grades into the Monte ecoregion, an area dominated by dry thorn scrub and grassland.

Any visitor to Patagonia in the austral spring / early summer (November to January) cannot fail to be impressed by the floriferousness and intense perfume of the many species of *Junellia* at peak flowering. A few are in cultivation, though barely, and more await introduction. Growth form is variable between species, from upright shrubs at one extreme to tight ground-hugging cushions or mats at the other. Even within some species, growth form can be variable making identification sometimes difficult. Some species also show marked variation in flower colour. All are woody and perennial.

Although some *Junellia* species are in cultivation, and as most are extremely variable in growth form and flower colour, it is well worth sowing seed when available, and selecting garden worthy forms.

In this pictorial guide to Patagonian *Junellia* species I aim to illustrate variation in growth form and flower colour within species. I have divided them into those species with and those without spiny leaves; otherwise species are considered alphabetically.

Junellias with non-spiny leaves

This group contains those species, usually with small succulent leaves, that are found chiefly on the steppe. There are also two montane species.



Fig. 2 – *J. azorelloides*. Leaf detail, underside left, upper surface right.

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***Junellia azorelloides* (Spegazzini) Moldenke**

This is a steppe species recorded from southern Mendoza, Chubut and Santa Cruz at altitudes of 300-1,200m, though I have only found it in the extreme south and I think the Mendoza records may be suspect. Small rosettes form a tight mat or low cushion to about 40cm across, with pubescent entire leaves, glabrescent on their upper surface. Flowers are in clusters, often restricted to the periphery of the mat. Flower colour varies from pink/purple, lavender to white, usually becoming darker when the flowers age or are fertilised. Flowering November to January. The species is in cultivation, though has on occasion been confused with *J. tridactylites*. [Figs 1, 2, 3, 4]



Fig. 3 – *J. azorelloides* showing typical arrangement of flowers around the periphery of the mat.



Fig. 4 – *J. azorelloides*. White flowered form with flower detail.



Fig. 5 – *J. congesta* showing mat growth form, tight rosettes and deep pink flower buds.

***Junellia congesta* (Troncoso) Moldenke 1200km**

This unusual and beautiful species was originally described from mountains near Zapala (Neuquén) in northern

Patagonia. We were unable to find this species at its *locus classicus*, or elsewhere until we identified a population 1,200km to the south at Paso Zeballos (Santa Cruz), where it grows among stones and sandy soils in areas of snowmelt at



around 1,500m (recorded at around 2,500m at the Zapala site).

Fig. 6 – *J. congesta*. Leaf detail, upper surface left, underside right.

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This population differs in several respects from the original description and the exact taxonomic status needs further investigation. The species forms a low mat to about 35cm across. Flowers are in



clusters of 10-30 at the tips of the shoots (10-12 at the *locus classicus*), white, opening from deep pink buds (rarely plants have white buds). Flowering December to January. The species has proved difficult in cultivation, growing well but either failing to flower or flowering poorly – perhaps a species to try in cooler areas. [Figs 5, 6, 7, 8]

Fig. 7 – *J. congesta*. Flowers opening white, forming spherical heads.

Fig. 8 – *J. congesta*. Unusual form lacking pink pigment.



Fig. 9 – *J. coralloides*.
Flower detail.

***Junellia*
coralloides
Sheader &
Sheader**

This is a plant of the drier steppe from Neuquén to northern Santa Cruz. It is close to *J.*



patagonica, but differs in scent, in having 3-lobed leaves and by its contorted, arching or decumbent growth with congested reduced side shoots. Foliage can be green, grey-green or grey-purple in colour. Flowers are white to pale yellow, arranged in a congested globose spike of up to 40 at the apices of side shoots towards the end of the main stems. Flowering November to January. This species grows and flowers well in cultivation. [Figs 9, 10, 11, 12, 13]

Fig. 10 – *J. coralloides* showing congested growth form in habitat.





Fig. 11 – *J. coralloides* showing coralloid growth form in habitat.



Fig. 12 – *J. coralloides*. Typical pale yellow-flowered form in cultivation.



Fig. 13 – *J. coralloides*. White-flowered form in cultivation.



Fig. 14 – *J. aff. coralloides*.
Growth habit.

Junellia aff. coralloides

Another arid steppe species first recorded by Kirsten and Lars Andersen on the eastern side of Lago Cardiel (Santa Cruz) at about 350m, but

also recorded further north in Chubut. This is a small scrambling shrub forming loose mats to about 15cm across. Leaves of the main stem are 3-lobed, those of the reduced side shoots entire. Flowers

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are in clusters of up to 13 at the apices of the main shoots and are bright yellow ageing to orange-red. Flowering November to December. This is not in cultivation, but would be well worth trying should seed become available. [Figs 14, 15, 16]



Fig. 15 – *J. aff. coralloides* with yellow flowers ageing to red.



Fig. 16 – *J. aff. coralloides* showing flower detail.



Fig. 17 – *J. micrantha* habitat.

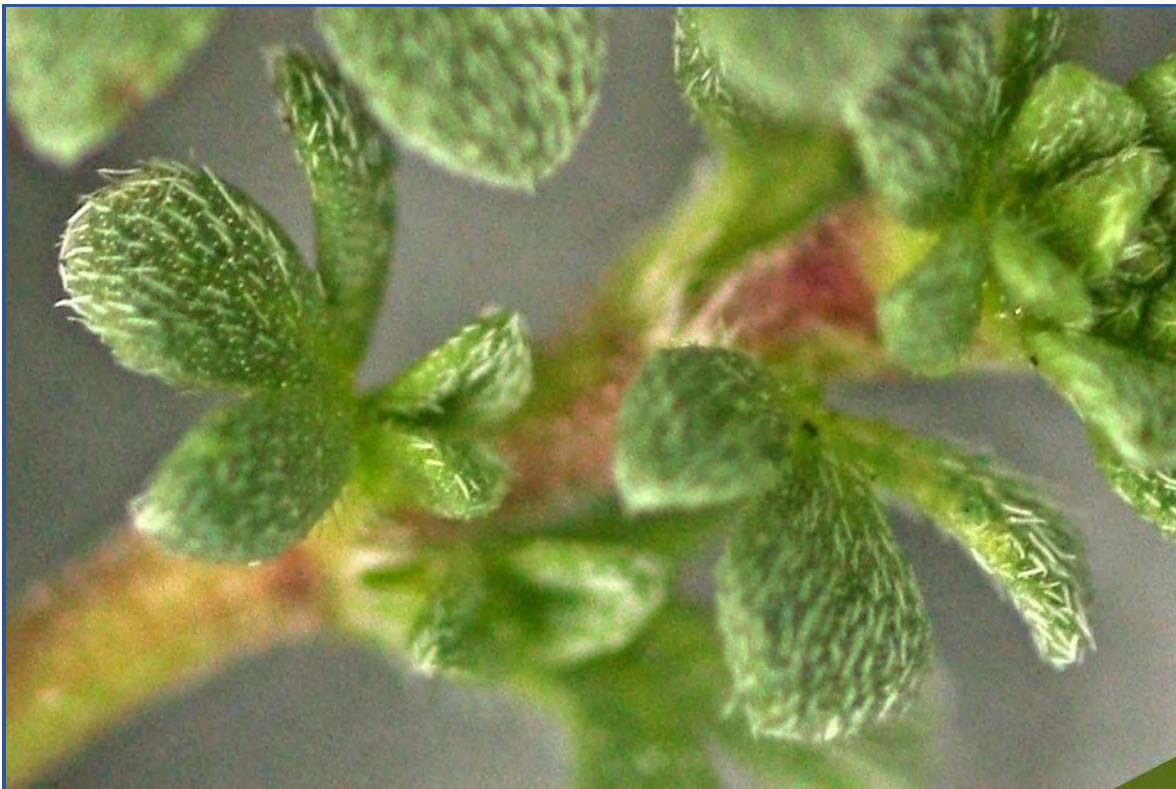


Fig. 18 – *J. micrantha*. Leaf detail.

***Junellia micrantha* (R.A. Philippi) Moldenke (syn. *J. wilczekii*)**

This is a steppe / mountain species which is found in locations throughout Patagonia at elevations up to 3,500m. It usually occurs in areas that are seasonally wet – lake margins, depressions – that become dry later in the year. It grows as a ground-hugging flat mat up to 50cm across. Leaves have 3 rounded lobes and the small flowers are in spikes of 20-30. Flower colour varies - white, pale lilac,

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violet or pink, with dark spots around the throat at the base of the petals. Flowering October to February. This species is in cultivation, flowering well both in the alpine house and in raised beds / troughs outside. Leaves die back in winter. [Figs 17, 18, 19, 20, 21]



Fig. 19 – *J. micrantha*. Violet-flowered form.



Fig. 20 – *J. micrantha*. White-flowered form.



Fig. 21 – *J. micrantha*. Pink-flowered form.



Fig. 22 – *J. o'donellii*. Mat growth form.

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***Junellia o'donelli* Moldenke**

This is a steppe species found through Patagonia at elevations up to about 1,100m. It grows as two distinct forms, one forming tight cushions or mats to about 30 cm across, and the other a loose-growing upright shrub to about 30cm tall. There is need for a thorough taxonomic study here. Leaves are 3-lobed, clasping the stem, with the lateral lobes much shorter than the central lobe. All three lobes are acute. Flowers, which are usually white or pink, are in clusters of 3-10 at the apices of the reduced side shoots. Flowering December to January. The species is or has been in cultivation.

[Figs 22, 23, 24, 25]



Fig. 23 – *J. o'donellii*. Leaf detail, upper surface left, underside right.

Fig. 24 – *J. o'donellii*. Flower detail.



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Fig. 25 – *J. o'donellii* showing upright shrubby growth form.



Fig. 26 – *J. patagonica*. Cushion growth form with flowers around the periphery.



Fig. 27 – *J. patagonica*.
Large cushion with flowers
ageing to pink.

Junellia patagonica
(Spegazzini) Moldenke

Junellia patagonica is a dry
steppe species found through
Patagonia up to an altitude of
about 2,000m. In its *locus*
classicus in southern Santa
Cruz it grows as a tight grey-
green cushion to about 30cm

across. In the north, cushions, looser mats or more upright shrubby plants can be found. The tiny leaves are entire with a characteristic tuft of hairs on the underside of the leaf base. Flowers are produced in terminal clusters of about 12, typically around the periphery of the cushion, and are white, ageing to deep pink. Flowering November to December. It grows and flowers well in cultivation but is rarely available. [Figs 26, 27, 28, 29, 30]



Fig. 28 – *J. patagonica*. Flower detail.



Fig. 29 – *J. patagonica* growing as a loose prostrate mat.



Fig. 30 – *J. patagonica* growing as upright shrub.



Fig. 31 – *J. silvestrii*. Large cushion in habitat.



Fig. 32 – *J. silvestrii* showing the white flowers opening from deep pink buds.

Junellia silvestrii
(Spegazzini) Moldenke

A distinctive species from the extreme south of Patagonia, where it can be found from dry open steppe habitats to cliff top barrens at altitudes of 100–1,200m.

Fig. 33 – *J. silvestrii* showing flower and foliage detail.

It forms densely-branched, hard, dark-green mats or cushions up to about 1m across. Leaves are glabrous and entire.



Flowers are

single or in pairs, white, opening from pink buds. Flowering November to January. The species has been in cultivation but rarely flowers as well as it does in habitat. [Figs 31, 32, 33]



Fig. 34 – *J. succulentifolia*. Plant in habitat.



Fig. 35 – *J. succulentifolia*. Leaf detail, upper surface left, lower right.

***Junellia succulentifolia* (Kunze) Moldenke**

A dry steppe species recorded from Neuquén south to Chubut at altitudes 400-1000m, often growing among rocks or at the base of cliffs. Plants form loose, upright shrubs or cushions up to 50cm high and 1m across. Leaves are 3-lobed with small lateral lobes and with revolute margins. Flowers, which

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can be white, lilac or pale blue, are in spikes of 10-30 at the apices of the branches. Flowering October to January. This species thrives in cultivation and flowers well. [Figs 34, 35, 36, 37, 38]



Fig. 36 – *J. succulentifolia*. Detail of flower spikes.



Fig. 37 – *J. succulentifolia*. Plant in habitat.



Fig. 38 – *J. succulentifolia*. Detail of flower spikes.



Fig. 39 – *J. thymifolia*. Plants in habitat.



Fig. 40 – *J. thymifolia*. Stem and leaf detail – note long internodes.

Junellia thymifolia
(Lagasca)
Moldenke

This is a widespread steppe species found through Patagonia,

but especially common in the south. It forms a low upright shrub to about 30cm high. Leaves are

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entire with recurved margins and the stem internodes are long relative to leaf size. Flowers are white, lilac or pink ageing to deep pink, in clusters of 10-12, at the apices of the main stems. Flowering October to January. This species is in cultivation and flowers well, but is not as floriferous as in habitat. [Figs 39, 40, 41, 42, 43]

Fig. 41 – *J. thymifolia* showing flower detail.



Fig. 42 – *J. thymifolia*. White-flowered form.

Fig. 43 – *J. thymifolia*.
A pink-flowered plant with flowers ageing to deep pink.



Fig. 44 – *J. tridactylites*. Plant in habitat showing typical growth form.



Fig. 45 – *J. tridactylites*. Detail of leaves.



Fig. 46 – *J. tridactylites*. Yellow-flowered plant with mat growth form.



Fig. 47 – *J. tridactylites*. Yellow- and white-flowered mats merging.



Fig. 48 – *J. tridactylites*. Yellow-flowered form ageing to pink.



Fig. 49 – *J. tridactylites*. A broad-petalled white-flowered form ageing to pink.



Fig. 50 – *J. tridactylites*.
A pink-flowered form
ageing to deep pink.

Fig. 51 – *J. tridactylites*. A
white-flowered
form.



***Junellia*
tridactylites
(Lagasca)
Moldenke**

This junellia is a
widespread
steppe species

found through Patagonia. It is extremely variable species, both in terms of growth form and flower colour, and is perhaps in need of further taxonomic study to elucidate the status of the various forms. It can grow as a mat, cushion, or as a prostrate or upright shrub, up to 25cm high and 50cm across. Leaves are 3-lobed. Flowers are in spikes of 10-15 at the apices of the main branches. Flowers can be white, pink, violet or cream-yellow. Flowering December to January. A few clones of this species are in cultivation, but there are much better forms in habitat. [Figs 44, 45, 46, 47, 48, 49, 50, 51]



Fig. 52 – *J. uniflora* showing mat growth form.

Fig. 53 – *J. uniflora*. Detail of flowers and foliage.

Junellia uniflora
(R.A. Philippi)
Moldenke

This is a high mountain species growing among rocks and stable screes at 3,200-4,000m, forming hard mats to about 50cm across. The tiny leaves are entire,



forming tight rosettes. Flowers are solitary (occasionally in pairs) and are white to pink, ageing to pink or crimson. Flowering December to January. Seed has been available in recent years, but there is little information as to success. [Figs 52, 53]

Junellias with spiny leaves

These are all steppe or monte species and have rigid acute leaves on the main stems. A few of them can also be found in dry habitats at altitude.

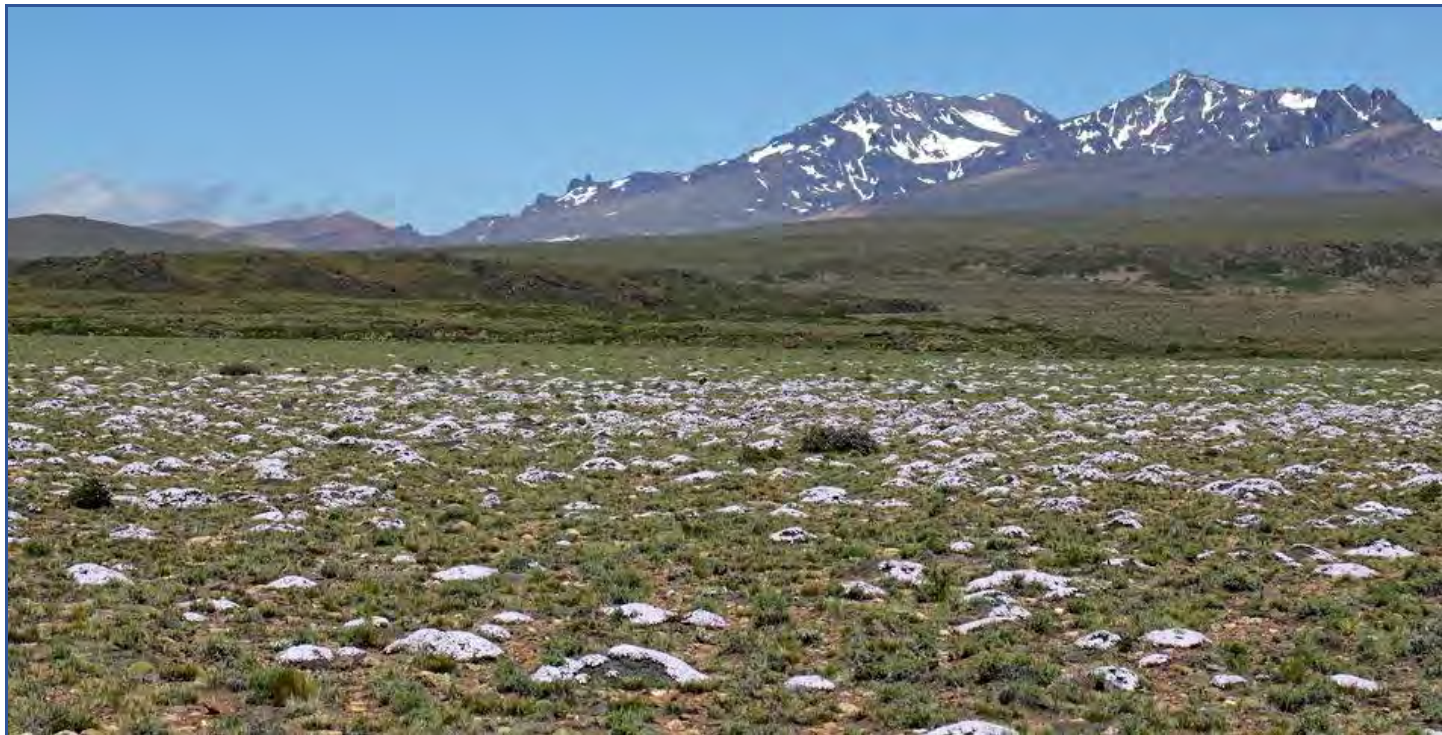


Fig. 54 – *J. caespitosa*. Cushions in habitat.

Junellia caespitosa (Gillies & Hooker) Moldenke

A species occurring in northern Patagonia, often at altitude (1,300m, but up to 4,000m further north), where it grows in sandy or rocky habitats. Leaves on the main stem are linear, forming spines, those on the reduced side shoots oval and fleshy. Plants form low cushions to about 50cm across. Flowers are white or pale lilac ageing to violet, and are in pairs at the apices of the side shoots. Flowering

December to January. Probably not in cultivation. [Figs 54, 55, 56, 57, 58, 59]



Fig. 55 – *J. caespitosa*. Cushion with lavender flowers.

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Fig. 56 – *J. caespitosa*. Detail of leaves and flowers.



Fig. 57 – *J. caespitosa*. Cushion with white flowers.



Fig. 58 – *J. caespitosa*. Detail of pink-flowered plant.



Fig. 59 – *J. caespitosa*. Cushion with pink flowers.



Fig. 60 – *J. connatibracteata*. Plants in habitat.



Fig. 61 – *J. connatibracteata*. Details of flowers and foliage.

***Junellia connatibracteata* (Kunze) Moldenke**

A northern species extending as far south as northern Chubut and at altitudes up to about 2,300m, where it grows in dry sandy habitats. Plants form low mounds 15-60cm high. Opposite leaves on the main stems are connected at their bases, and are rigid and sharp, triangular in cross-section and generally recurved. Leaves on the side shoots are oval and fleshy. Flowers are cream-white to pink or lilac and are arranged in many-flowered clusters at the apices of the side shoots. Flowering December to February. Probably not in cultivation. [Figs 60, 61, 62, 63]



Fig. 62 – *J. connatibracteata*. Pink-flowered plant.



Fig. 63 – *J. connatibracteata*. White-flowered plant.



Fig. 64 – *J. erinacea*. Cushions in habitat.

***Junellia erinacea* (Gillies & Hooker) Moldenke**

This is a spectacular large northern monte species, extending as far south as northern Río Negro at altitudes of 2,500-3,000m, where it grows in dry sandy habitats. Plants form large mounds to about 30cm high and 70cm across. The opposite spine-like leaves are joined at their bases. Flowers are blue, lilac or white, in clusters of 2-3 at the apices of the side shoots. Flowering December to February. Barely in cultivation. [Figs 64, 65, 66, 67]



Fig. 65 – *J. erinacea*. Detail of foliage.



Fig. 66 – *J. erinacea*. White-flowered plant showing flowers and foliage.



Fig. 67 – *J. erinacea*. Blue-flowered plant showing flowers and foliage.

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Fig. 68 – *J. spissa* showing mat growth form.



Fig. 69 – *J. spissa*. Detail of flowers and foliage.

***Junellia spissa* (Sandwith) Moldenke**

This is a mat-forming shrub to about 30cm across, occurring on arid steppe and hillsides to about 2,300m, Neuquén to Chubut. Leaves on the main stems are linear and sharp, those on the side shoots acute, fleshy, and arranged in 4 rows. Flowers are white to pale lilac, in pairs at the apices of the side shoots. Flowering November to February. Probably not in cultivation. [Figs 68, 69]



Fig. 70 – *J. toninii*. Plants in habitat.



Fig. 71 – *J. toninii*.
Detail of flowers and
foliage.

Junellia toninii
(Kunze) Moldenke

A common steppe species throughout Patagonia, it forms low or hemispherical cushions to 15cm high, or upright shrubs to about 40cm high.

Leaves of the main

stem are spiniform, those of the reduced side shoots oval and acute. Flowers are white, blue or lilac in clusters of up to 10 at the apices of the main shoots. Flowering November to January. Probably not in cultivation. [Figs 70, 71, 72, 73, 74, 75]



Fig. 72 – *J. toninii*. Large white-flowered cushion.



Fig. 73 – *J. toninii*. Cushion with pale lilac flowers.

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Fig. 74 – *J. toninii*. Cushion with pale flowers ageing to deep violet.



Fig. 75 – *J. toninii*. Cushion in habitat.



Fig. 76 – *J. ulicina*. Loose spreading mat.

***Junellia ulicina* (R.A. Philippi) Moldenke**

This is a steppe species growing in sandy or rocky habitats throughout Patagonia, though it is generally commoner in the north, growing at altitudes from sea level to 3,200m. It forms a small spreading shrub to 20cm high. Leaves on the main stems have 3 spine-like lobes, whereas those on the reduced side shoots are also 3-lobed, but non-spiny.

Flowers are ivory to white with pink-violet tubes and are in clusters of 2-3. Flowering December to February.

Probably not in cultivation.

[Figs 76, 77, 78]



Fig. 77 – *J. ulicina*. Leaf detail showing 3-lobed spiny form.



Fig. 78– *J. ulicina*. Flower detail.

Many of these *Junellia* species are adapted to cool, dry conditions. Hopefully, more of these species will eventually make their way into cultivation in suitable areas.

In the second part of this article I will consider other Patagonia Verbenaceae from a range of habitats, including temperate rain forest, woodland, monte and steppe – *Acantholippia*, *Diostea*, *Glandularia*, *Mulgurea*, *Neosparton*, *Phyla* and *Rhaphithamnus*.

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