

# *Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov and *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov (Iridaceae), Two New Species from Lebanon

## Abstract

*Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov from Kfar Houneh and Aaramta (Jezzine District) and *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov from Jabal Niha and Tawmat Niha (Al Shouf District) are nominated as novel species. Not only do the new two species vary from other existing *Romulea* in terms of taxonomic structures such as (corm, tunic, leaves, shape of the perianth, segment flower, flower tube, style, filaments, anthers, seeds, color of the pollen and others), but they also vary from Lebanese *Romulea*. They are depicted by cold winters with frequent precipitation as snow (annual rainfall 600-1000ml). Plant material and morphological analyses are done, measurements, colors, and other details given in the description are based on both herbarium and fresh materials. Morphological data were taken from more than 10 specimens of each. *Romulea jezzinis*; Plant, green with striped funnel-shaped dark blue, violet blue, dark violet-blue or pale blue flowers. Corm, ovoid asymmetrical, with a narrow semicircle shaped bottom protuberance, corm tunic, 2-4 layers, leathery, brown to deep brown, imbricate; leaves, (aerial part) 4-5, linear, plicate, grooved at upper surface, erect, or recurved, one to 3 times as long as scape; basal leaf transverse section, oval-elliptical, grooves are circular to longitudinal elliptical, filament white speckled with blue or violet blue, thick, sometimes little hairy below, anther, white grooved and stripped on its outer and inner face edges by blue or violet blue, style (at perianth segments), blue or violet blue (pale on its bottom third), glabrous, grooved, much longer than stamens, stigma, branching into 3 short, curved strands and each one branches into two (stigma always overtops anthers), seeds, (up to 24 seeds in each capsule), nearly globular to ovate, pale brown to brown, and has a reticulate-foveate surface. *Romulea libanotica*; Plant green, with funnel-shaped blue or violet-blue striped white flowers, 80-200 mm high. Corm, ovoid, asymmetrical with a semicircle shaped bottom protuberance up to 3 stems can grow from the same corm at the same time, corm tunic, 3-6 layers, leathery, deep brown, imbricate, leaves, 3-8, linear, plicate, grooved at upper surface, erect, or recurved, one to two and a half as long as scape, inflorescence up to 5 flowers; Anther, 3, pale yellow (with dark yellow pollens), linear, grooved, longer than filament, style (at perianth segments), 1, white, glabrous, non-grooved, much longer than stamens, bifid on its last quarter to form stigma, stigma, 3, branching into 6 short, curved strands, overtops anthers; capsule, 1-5, elliptical with direct pedicel, up to 30 seeds in each capsule, seeds, nearly globular to ovate, brown to reddish brown, and has a reticulate-alveolate surface up to 30 seeds in each capsule. Voucher specimens (Holotypes) are deposited in K. Addam Herbarium Arts, Sciences and Technology University in Lebanon. More descriptions, illustrations and notes on distribution and ecology are provided inside the publication.

**Purpose of the study:** The purpose of the present work is to inspect the morpho-anatomical features of two species of *Romulea* to attest the discovery of two new world records. The gathered data and captured photographs of these two new species' fresh samples resulting from this study will be helpful in the morphological descriptions and the works related to the flora of Lebanon. Most of the anatomical findings are obtained for the first time and the results are reliable sources for identifying *Romulea*'s new taxa.

**Keywords:** Iridaceae, two new species, *Romulea*, Mediterranean, Lebanon endemic flora, taxonomy

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## Introduction

Iridaceae is a distinct family including about 2000 species ranging between 60 and 70 genera.<sup>1</sup> In recent years, despite the dynamic taxonomic treatments of the world's vascular flora, the Iridaceae family holds relative stability in terms of its taxonomic structure's volume.<sup>2</sup>

*Romulea* Maratti (1772: 13) is a monocot genus (Iridaceae, subfam. Crocoideae Burnett, syn = Ixioidae). Ixioidae, entailing over 800

species and about 30 genera, is the largest subfamily of Iridaceae. It is a coherent subfamily in both its morphological and anatomical characters that includes the genus *Romulea*.<sup>3</sup>

Within the genus, the species are comprised in the *Romulea* section and *Romulea* series.<sup>4,5</sup> The most recent revision of the sub-Saharan species divides the genus into two subgenera and six sections, based mainly on the corm's characters.<sup>6</sup>

Marrati was the first to portray the name Romulea, which was borrowed from the city of Rome, in vicinity in a small taxonomic study published in 1772. He suggested that this species was distinct from *Crocus*, *Colchicum*, *Sisyrinchium*, *Bulbocodium*, and *Ixia*, and was comprised at first in the genus *Crocus* L. and then in the genus *Ixia* L.<sup>7</sup>

Romulea is a genus with several species of possible horticultural value. The fast growth, attractive growth forms, regular flowering, and various flower distinction with many aesthetically delightful colors, make the species of this genus major candidates for commercialization as miniature potted plants and cut flowers.<sup>8,9</sup>

The genus Romulea (Maratti) has African-Eurasian distribution and encompasses about ±97 taxa after the description of five novel species and a further two highly local endemics bringing the number of species recorded from southern Africa to 83.<sup>10</sup>

Nonetheless, the majority of the publications that were checked during our literature review confirm and depend on 95 taxa as a number for all species.<sup>7,11–16</sup>

Approximately, 80 taxa arise in South Africa (sub-Saharan Africa), Arabian Peninsula and Socotra.<sup>17</sup> While the remaining 15 taxa arise in the Mediterranean Basin, Canary Islands, the Azores, and southern Europe.<sup>13,16</sup> About 20 species exist in the South Mediterranean Province and the Atlantic Europe and 20 taxa exist as mentioned by some scholars.<sup>18,19</sup>

Although some studies on Mediterranean species of Romulea were published (MARAIS, 1984; RITA, 1989- 1990; TURLAND & al., 1993; EROL & KÜÇÜKER, 2003; FIELD ING & TURLAND, 2005), there are no precise or comprehensive revisions of the Euro-Mediterranean species currently available.<sup>20</sup>

But at present, some 30 taxa are currently accepted by Euro+Med (2006–2018), 20 of which are endemic or sub-endemic to the Mediterranean region, specifically to Morocco and other north African territories.<sup>21</sup> The high morphological similitude between closely related taxa in the Iridaceae is possibly due to the recent divergence and the subsequent radiation-adaptive process that provokes species complexes.<sup>22,23</sup>

Lately, to solve these problematic analyses about pollen, stigmas and stomata morphology, karyology and molecular biology are still in progress to inspect a phylogenetic study of this genus and attempt solving some taxonomical doubts.<sup>19</sup> These countless taxa of different rankings were depicted from the Mediterranean region, with major contributions authored by Parlatore (1860), Beguinot (1907, 1908, 1909) and Manning & Goldblatt (2001).<sup>4,24–28</sup>

Approximately 15 Mediterranean species of Romulea embrace a natural group of singular systematic value as a result of their biogeographical history.<sup>13</sup>

The East Mediterranean, particularly the Levantine uplands<sup>4</sup> where Lebanon is included in this basin, is regarded as one of the most interesting spots of conservation in the world.<sup>5</sup> It is a principle region in the Mediterranean basin where it possesses one of the dominant densities of floral diversity. One of the most incredible features about Lebanon is the existence of such biodiversity in a very restricted area. In fact, what seems common at a local level might be highly scarce at a global one.<sup>29–31</sup>

Romulea genus seems to be more spread in regions with typically Mediterranean climate, with mild winters, hot and dry summers, and autumn-spring rainfall,<sup>20</sup> which is typical to the climate of Lebanon.

This unique Mediterranean climate, geological breeding, and topographical diversity are the key features that represent Lebanon as a vital reserve for multifarious sporadic, native, and endemic species (predominantly some of the very rare endemic which makes it one of the world's most prodigious spots for conservation).<sup>32</sup>

In the sixties, Lebanon was globally distinguished as “Green Lebanon” due to the forests that cover this small country with widely spread native flora.<sup>33</sup>

The distribution of the genus Romulea in Lebanon is restricted to areas having a Mediterranean climate<sup>34</sup> and contains five species:

Romulea bulbocodium (L.) Sebast. & Mauri Figure 1a, Romulea columnae Sebast & Mauri Figure 1b, Romulea nivalis (Boiss. & Kotschy) Klatt Figure 1c, Romulea phoenicia Mouterde Figure 1d and Romulea ramiflora Ten (Figure 1e).<sup>35</sup>

Romulea nivalis endemic to Lebanon, Syria and Palestine and considered Vulnerable and its current population trend decreasing (Figure 1c).<sup>36</sup>

Moreover, Romulea phoenicia is endemic and has most recently been assessed for The IUCN Red List of Threatened Species in 2016. Romulea phoenicia is listed as Vulnerable under criteria A4c (Figure 1d).<sup>37</sup> During our reading of the previous information about Romulea Phoenicia<sup>37</sup> and in another place,<sup>38</sup> we noticed that there are paradoxes that are not true, and this requires clarification.



Figure 1 The five species of Romulea that grow in Lebanon.

So, commenting on what was stated in the publication issued by the IUCN Red List of Threatened Species about Romulea phoenicia<sup>37</sup> and the information of the Royal Botanical Garden Kew about Romulea phoenicia too,<sup>38</sup> it is tragicomic to publish such an information issued by such a famous global union and Kew. As if the authors did not bother themselves to read the description written by Mouterde who discovered But this plant they also put pictures of another Romulea that does not relate to the original one, (Romulea phoenicia), which is considered endemic to Lebanon. We even do not know if it exists in Palestine, especially if its dependence in terms of diagnosis is on such authors who wrote this publication. Why wasn't this publication edited and checked by specialists in this family (Iridaceae)? And how did they let such wrong information pass, in which there are errors in plant anatomy that are not even hidden from beginners? You are required to delete and cancel this publication, as it contains misleading information for researchers and future generations. Thus, clarification is required. Providing you with the pictures taken from (Broummana), the place where discoverer of R. Phoenicia, P. Mouterde, Figure 2 found for the first time, coupled with the description of Romulea

phoenicia as written by him,<sup>35</sup> and the results of our dissection and taxonomy, will give you a full picture to acknowledge and compare with the mistake that was committed.



Figure 2 *Romulea phoenicia* Mouterde Found Broummana.

### Description of *Romulea phoenicia* Mouterde. Figure 1d and Figure 2

Corm; bulbiform 1-1cm, Corm tunic leathery, brown, Stem short, flowers 1-3, Leaves Linear leaves 1-1 mm wide, 2 or 3 times longer than the stem, up to 20cm, Bract (lower spathe valve), 1cm, green, ribbed, bordered with purple membranous margins, Bracteole (upper spathe valve) 5-7mm., green, with pale purple membranous margins, Perianth Tepals 1-1cm (1.7cm), yellow at the throat, a beautiful pink higher, Throat, yellow, Perianth tube very short, Filament glabrous at the base, Anther yellow (< 0.5cm), exceeding the style, Style yellow overtaken by anthers.

A lot of scientists get confused distinguishing the identity between *Romulea phoenicia* Mouterde. and *Romulea ramiflora* Ten. because they look very similar. Indeed, they are not similar at all and that is why we want readers to compare the taxonomy of *R. Ramifolia* (Figure 1e) set by Mouterde and our field work observations in a table of comparison (Figure 3).

	<i>R.phoenicia</i>	<i>R.ramiflora</i>
Corm	bulbiform 1-1 cm	oval
Corm Tunic	leathery, brown	leathery, cracked at base and top.
Stem	Short	long
Flower	1-3	1-6
Leaves	Linear leaves 1-1mm wide, 2 or 3 times longer than the stem, up to 20 cm	
Bract (lower spathe valve)	1 cm, green, ribbed, bordered with purple membranous margins	12-15 mm, striped
Bracteole (upper spathe valve)	5-7 mm., green, with pale purple membranous margins.	12-15 mm, striped, with membranous margins at the base
perianth	Tepals 1-1 cm (1.7 cm), yellow at the throat, a beautiful pink higher	Perianth 10-15 mm long, with citron yellow or whitish hairy throat and pale-lilac tepals, rarely violet. The three outer perianth segments have the back of greenish yellow, with 1-3 longitudinal stripes of bright violet
Throat	yellow	citron yellow, hairy
Perianth Tube	very short	
Filament	glabrous at the base	hairy at the base
Anther	yellow (< 0.5 cm), exceeding the style.	yellow, 2 cm long, more or less exceeding the style
Style	yellow overtaken by anthers	

Figure 3 Taxonomic comparison between *Romulea ramiflora* and *Romulea Phoenicia*.

### Description of *Romulea ramiflora* Ten

Corm oval, Corm tunic leathery, cracked at base and top, Stem long, Flowers, 1-6, Bract (lower spathe valve) 12-15mm, striped, Bracteole (upper spathe valve) 12-15mm, striped, with membranous margins at the base, Perianth 10-15mm long, with citron yellow or whitish hairy throat and pale-lilac tepals, rarely violet, the three outer perianth segments have a greenish yellow back, with 1-3 longitudinal stripes of bright violet, Throat citron yellow, hairy, Filament hairy at the base, Anther yellow, 2cm long, more or less exceeding the style.

Khodr Addam and M. Bou-Hamdan have worked on the bulb plants of the Lebanese flora for more than 22 years and have had a lot of publications<sup>39-47</sup> especially those which have focused on the Iridaceae family since 2017.<sup>31,33</sup>

Few other scientists mentioned the Iridaceae family in their studies. George Poste,<sup>48</sup> Paul Mouterde,<sup>35</sup> Khodr Addam, Mounir Bou-Hamdan,<sup>31,33</sup> and Georges and Henriette Tohmé<sup>49</sup> mentioned a lot of species from this family in their books and publications, even Mouterde (as mentioned before) discovered *Romulea phoenicia*.<sup>35</sup>

### Materials and methods

*Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov was collected in 18-III-2017 from Kfar Hounch and Aaramta, (Jezzine District), about 77.6 km far from Beirut, while *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov was collected in 15-III-2020 from Jabal Niha and Tawmat Niha, (Al Shouf District), about 65km far from Beirut,. They were observed to thrive in hundreds in villages located in Caza Jezzine and Al Shouf. Observations were grounded on fresh materials of both new species. *Romulea* taxa loses most of its diagnostic characteristics when dried. Therefore, we measured and evaluated all morphological characters from fresh forms. The seeds took about four months of observation after the blooming. A detailed account accompanied by specific illustrations and tabulated datasets are given to address this taxonomy. Both new *Romulea* species were discovered by Mr. Mounir Bou-Hamdan and confirmed by the herbarium samples of examined taxa (Holotypes) By Khodr Addam and deposited in Dr. Addam's Herbarium at AUL, Beirut-Lebanon, under the Accession No: Accession No:18-3-17-58-001 for *Romulea jezzinis*. (Figure 4) (Figure 5) and 15-3-20-58-001 for *Romulea libanotica*.<sup>5</sup>



Figure 4 Holotype of *Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov. deposited in K. Addam's Herbarium AUL (Lebanon).

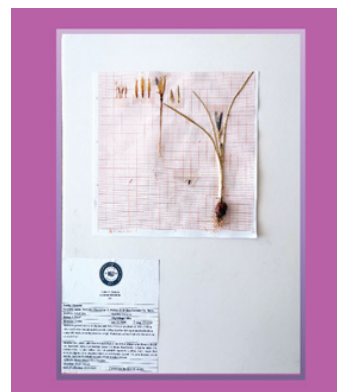


Figure 5 Holotype of *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov. deposited in K. Addam's Herbarium AUL (Lebanon).

During our 23 years of field work, we have found and registered all the species of Romulea mentioned to exist in Lebanon. The new described species have been observed during our several fieldtrips between 2017–2021.

### Description of the genus

Its species are small, bulbous plants with grooved cylindrical-leaves and actinomorphic flowers subtended by two herbaceous to scarious bracts.<sup>5,50,51</sup>

The genus is readily typical by its woody corm tunics, short-stemmed or stemless habit, grooved leaves, branched inflorescence with flowers solitary on each branch, firm-textured floral bracts with membranous margins and actinomorphic, usually short-tubed, campanulate flower. The features of the genus are thoroughly depicted by DE VOS (1970, 1972). The corm and its tunics are immensely variable in Romulea and appear to bring forth the most beneficial characters for infrageneric classification.<sup>18</sup>

### Morphological characteristics

#### *Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov (Figure 6) (Figure 7)

Plants, green with striped funnel-shaped dark blue, violet blue, dark violet blue or pale blue flowers, 80-160mm high. Corm, ovoid asymmetrical, with a narrow semicircle shaped bottom protuberance 8-14mm x 6-12mm diameter, more than 50 species have been examined on the field for years and only one stem was recognized to grow from the same corm. Corm tunic 2-4 layers, leathery, brown to deep brown, imbricate, the inner one is pale brown and membranous. The head of each tunic layer splits to many coarse fibers that look like uneven and irregular teeth of the comb and forms a short neck around the stem 2-8mm, with pale and very fine fibers come out from the neck and rise around the stem 10-30mm. Leaves (aerial part) 4-5, linear, plicate, grooved at upper surface, erect, or recurved, one to 3 times as long as scape. 40-140mmx.8-1.8mm. Basal leaves always 2, 60-140mmx1.2-1.8mm, curved, often longer and wider than the cauline leaves. Cauline leaves 2-3, 40-100mm x 0.8-1.4mm. erected, often shorter than the basal leaves. Basal leaf transverse section, oval-elliptical, grooves are circular to longitudinal elliptical, and have medium depth. 1.2-1.8mmx0.8-1.2mm. Inflorescence up to 3 flowers. Flower 1-3, 22-40mm, funnel-shaped, blue or violet blue (sometimes are pale) striped by dark blue or dark violet blue, 1.5 to 2 times longer than the spathe, with medium pedicel length 15-25mm. Perianth tube, short, 3-5mm. Perianth segments, blue or violet blue 20-35mm consists of 6 lanceolate petals 20-35mm, blue throat (sometimes dark blue or white). Outer perianth segment 3, 20-35mmx5.5-8.5mm, blue or violet blue (sometimes pale) lanceolate segments. Each one has 3 main dark blue, or dark violet blue vines extending along the segment with other 2 short vines on both sides extending from the segment bottom and reach its middle; the middle vine is straight while the lateral two are curved, spaced from it at the segment middle and converging it at both ends, dark blue or dark violet blue fine slashes exist at all segment area on both faces. The inner face in some cases has dark blue or white color between vines covering its lower half. Finally, the outer face of the perianth segment is always darker than the inner one. Inner perianth segment 3, 18–33mmx4.5-7.5mm, blue or violet blue (sometimes pale) lanceolate segments; each one has 3 main dark blue or, dark violet blue vines extending along the segment with other 2 short vines on both sides extending from the segment bottom and reach its middle, the middle vine is straight while the lateral two are curved, spaced from it at the segment middle and converging it at both ends, dark blue or dark violet blue fine slashes exist at all segment area

on both faces. The inner face sometimes has dark blue or white color between vines covering its lower half. In general, the outer face of the perianth segment is always darker than the inner one. Throat, white or dark blue, striped and not hairy at all. Filament 3, 5-8mmx0.8-1.2mm diameter, white speckled with blue or violet blue, thick, sometimes little hairy below. Anther 3, 8-11mmx1.6-2.2mm, white grooved and stripped on its outer and inner face edges by blue or violet blue (with white pollens), linear sagittate, longer than filament. Style (at perianth segments) 1, 20-30mmx0.6-0.8mm diameter, blue or violet blue (pale on its bottom third), glabrous, grooved, much longer than stamens, bifid on its last quarter in the top to form stigma. Stigma, branching into 3 short, curved strands and each one branches into two, total 6 strands, often every strand is striped on its edges by fine dark blue or dark violet blue lines, stigma always overtops anthers. Flower spathe reaches up to the half or more of perianth length (sometimes less than the half), bract and bracteole tips are often at the same level. Bract (lower spathe valve) 1, 20–44x4–6mm, green (striped with pale green or membranous fine vines) with very narrow clear membranous margins. Bracteole (upper spathe valve) 1, 16-40mm x 6-8mm, shorter and broader than bract, membranous with narrow striped green keel (striped with pale green or membranous fine vines), speckled with brown, tinged bluish or purplish. Stem Sheathing Scales 3, grooved membranous white pipe in the underground part, became green with narrow membranous edges in the aerial part, with diagonal tip shape. Capsule 1-3, Ovate with coiled pedicel 6-8mmx4-5mm diameter, up to 24 seeds in each capsule. Seeds (up to 24 seeds in each capsule), 1.7-1.9mmx1.5-1.7mm diameter, nearly globular to ovate, pale brown to brown, and have a reticulate-foveate surface.



Figure 6 *Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov.



Figure 7 Taxonomic dissection of *Romulea jezzinis*.

***Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov (Figure 8) (Figure 9)**

Plant, green, with funnel-shaped blue or violet blue striped white flowers, 80-200mm high. Corm, ovoid, asymmetrical with a semicircle shaped bottom protuberance 12-18x 6-16mm diameter, up to 3 stems can grow from the same corm at the same time. Corm tunic 3-6 layers, leathery, deep brown, imbricate, the inner layers are pale brown and membranous, the head of each tunic layer splits to many coarse fibers that look like the teeth of the comb and forms a short neck around the stem 5-20mm. Leaves 3-8, linear, plicate, grooved at upper surface, erect, or recurved, one to two and a half as long as scape, 40-200mmx1.2-3mm. Basal Leaves 2, curved, often longer and wider than the cauline leaves 50-200mm x 1.8-3mm. Cauline Leaves 2-6, erected, often shorter than the basal leaves 40-160mmx1.2-2mm. Leaf transverse section, oval-elliptical, grooves are transverse elliptical and have little depth, 1.2-3mmx0.8-2.2mm. Inflorescence up to 5 flowers. Flower 40-60mm, funnel-shaped, white striped by blue or violet-blue, 1.5 to 2 times longer than the spathe, with medium pedicel length 10-20mm. Perianth tube 0.5-1mm, very short. Perianth segments, white with 6 lanceolate petals and white throat. Outer Perianth segment 3, white lanceolate segments 20-40-x6-8mm, every outer one has 3 main dark blue vines running along the segment, the middle vine is straight while the lateral two are curved, spaced from it at the middle of the segment and converging it at both ends, on its both faces, wide strip of blue or violet-blue color covers the area between the 3 vines on the external face on all segment length keeps white edges around it with pale blue slashes in all segment area on both faces. Inner Perianth Segment 3, white lanceolate 20-40- x 4-6mm, every inner one has 3 main dark blue vines running along the segment, the middle vine is straight while the lateral two are curved, spaced from it at the middle of the segment and converging it at both ends, on its both faces, wide strip of blue or violet-blue covers the area between the 3 vines on the external face on the bottom half of the segment length (some are without), pale blue slashes at all segment area on both faces. Throat, white, hairy below. Filament 3, white, thick and hairy below, 4-7mm x 0.5-1mm diameter. Anther 3, pale yellow (with dark yellow pollens), linear, grooved, longer than filament 7-11x1.2-2mm. Style (at perianth segments) 1, white, glabrous, non-grooved, much longer than stamens, bifid on its last quarter to form stigma 16-24mmx0.4-0.7mm diameter. Stigma 3, branching into 6 short, curved strands, overtops anthers. Flower spathe reaches half or more of perianth length, bract & bracteole tips are often at the same level. Bract (lower spathe valve) 1, green, stripped with pale green or membranous fine vines, with very narrow clear membranous margins. 18-24x5-8mm. Bracteole (upper spathe valve) 1, shorter and broader than bract, membranous with narrow stripped green keel (stripped with pale green or membranous fine vines), speckled with brown, tinged bluish or purplish 14-20x4-7mm. Stem sheathing scales 3, grooved membranous white pipe in the underground part, became green with narrow membranous edges in the aerial part, with diagonal tip shape. Capsule 1-5, elliptical with direct pedicel, up to 30 seeds in each capsule. 7-10x4-7mm diameter. Seeds nearly globular to ovate, brown to reddish brown, and has a reticulate-alveolate surface 1.9-2.1x1.7-1.9mm diameter up to 30 seeds in each capsule.

**Distribution, habitat, phenology and ecology**

**1 *Romulea jezzinis* K. Addam & M. Bou-Hamdan sp nov.**

**Location**

Kfar Houneh (Jezzine District) Lat 33.469724 Long 35.585706, Alt1100m. 77.6 km far from Beirut (Figure 10).<sup>52</sup> Aaramta (Jezzine

District) Lat 33.450588 Long 35.575704, Alt 1000m. 81.9 far from Beirut (Figure 10).<sup>53</sup>



**Figure 8** *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov.



**Figure 9** Taxonomic dissection *Romulea libanotica*.



**Figure 10** Location of new *Romulea* species in Lebanon.

## Habitat

It grows at an altitude of 1000m to 1100m above sea level, where it thrives in a soil containing few stones and high moisture or waterlogged in open areas, also it grows in the western borders of the areas planted with aerial pine, where sunlight reaches it only from afternoon until sunset. The climate of the area is depicted by cold winters with frequent precipitation as snow (annual rainfall 600ml-1000ml), rigorous summers with extended physiological drought (Figure 11).



Figure 11 Close view of the habitat of *Romulea jezzinis*.

**Phenology** Feb – March.

## Ecology

Each population of *Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov. was normally observed to share its habitat with *Anemone coronaria*, *Gagea micrantha*, *Colchicum brachyphyllum*, *Thelygonum cynocrambe*, *Ranunculus hierosolymitanus*, *Sherardia arvensis*, *Bellis perennis*, *Romulea columnae*, *Ranunculus chius*, *Lepidium spinosum*, *Pinus pinea*, *Trifolium resupinatum*, *Taraxacum cyprum*, *Trifolium filiforme*, and many others.

The new species *Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov. epithet is attributed to Jezzine District (Casa) in the South Governorate of Lebanon. Town Jezzine is the capital of Jezzine District.<sup>52,53</sup>

## *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov.

### Location

Jabal Niha (Al Shouf District) Lat 33.5600 Long 35.6239, Alt 1550m, Jabal Niha (Al Shouf District) Lat 33.5657 Long 35.6277, Alt 1420m. Tawmat Niha (Al Shouf District) Lat 33.5173 Long 35.6157, Alt 1540m about 65 km far from Beirut (Figure 10).<sup>54</sup>

## Habitat

It grows in open mountainous lands free of trees, at an altitude of 1400m to 1650m above sea level and annual rainfall rate 600-1100m. It prefers thriving in mixed soils rich in stones with varying humidity from low to high. Winters are cool and tend to be wet (snow fall can reach 1m) (Figure 12).

## Ecology

Each population of *Romulea libanotica* was normally observed to share its habitat with *Anthemis hyaline*, *Trifolium medusaeum*, *Lepidium hirtum microstylum*, *Ranunculus schweinfurthii*, *Lathyrus marmoratus*, *Ixiolirion tataricum*, *Colchicum libanoticum*, *Anemone coronaria*, *Gagea micrantha*, *Crocus ochroleucus*, *Colchicum decaisnei*, *Thelygonum cynocrambe*, *Trifolium physodes*, *Ranunculus*

*hierosolymitanus*, *Phlomis chrysophylla*, *Bellis sylvestris*, *Androsace maxima*, *Sherardia arvensis*, *Eryngium creticum*, *Trifolium formosum*, *Crocus cancellatus f. cilicicus*l, *Taraxacum cyprum* and many others.



Figure 12 View of the habitat of *Romulea libanotica*.

**Phenology** middle of January to the middle of Marc

## Etymology

The new species *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov. epithet is attributed to Lebanon. Village Niha, where the new species was found, is a Lebanese local authority which is located in Shouf District (Casa), an administrative division of Mount Lebanon Governorate (Mohafazah).<sup>54</sup>

## Voucher Specimens

Two dried sample voucher specimens (Holotypes) were deposited in K. Addam Herbarium Arts, Sciences and Technology University (AUL) Lebanon.

**Holotype 1:** *Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov. Accession No.: 18-3-17-58-001, collected by Mr. Mounir Bou-Hamdan at 18-3-2017 and identified by Khodr Addam (Figure 4).

**Holotype 2:** *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov. Accession No.: 15-3-20-58-001, collected by Mr. Mounir Bou-Hamdan 15-3-2020 and identified by Khodr Addam (Figure 5).

## Discussion

*Romulea jezzinis* K. Addam & M. Bou-Hamdan sp. nov from Kfar Houneh and Aaramta (Jezzine District) and *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov from Jabal Niha and Tawmat Niha (Al Shouf District) are nominated as novel species. The new two species vary from other existing *Romulea* in terms of some taxonomic structures such as (corm, tunic, leaves, and shape of the perianth, segment flower tube, anthers' style and seeds, color of the pollen, and others). They also vary from Lebanese *Romuleas*.

The flower of *R. jez* is blue or violet blue (some cases are pale) striped by dark blue or dark violet blue, 1.5 to 2 times longer than the spathe, while *R. lib.* is white striped by blue or violet blue. The corm of *R. jez* has narrow semicircle shaped bottom protuberance that does not exist in *R. lib.* The corm tunic of *R. jez* contains pale and very fine fibers coming out from the neck and rising up around the stem. The basal leaves of both *Romuleas* are often longer and wider than the cauline leaves. It was observed that the leaves of *R. lib* that grows

at an altitude of 1500m to 1650 m are shorter. Basal leaves transvers section reveals that the grooves of R. jez have medium depth while those of R. lib. have little depth. The perianth segments of R. jez. are blue or violet blue with 6 lanceolate petals, with blue, dark blue or white throat. The perianth tube of R. lib is very short. The outer perianth segment of R. jez consists of 3 blue or violet blue, (some cases pale) lanceolate segments, each one has 3 main dark blue (or dark violet blue) vines extending along the segment with 2 other short vines on both sides extending from the segment bottom and reach its middle. The middle vine is straight while the lateral two are curved, spaced from it at the segment middle and converging it at both ends. With dark blue (or dark violet blue) fine slashes in all segment area on both faces. The inner face in some cases has dark blue or white color between vines covering its lower half. In general, the outer face of the perianth segment is darker than the inner one. On the other hand, the outer perianth segment of R. lib. consists of 3 white lanceolate segments whereby each one has 3 main dark blue vines running along the segment. The middle vine is straight while the lateral two are curved, spaced from it at the segment middle and converging it at both ends on its 2 faces and a wide strip of blue or violet blue covers the area between the 3 vines on the external face on all segment length keeps white edges around it with pale blue slashes in all segment area on both faces. The differences in the taxonomy of outer perianth segment of both Romuleas reveal the uniqueness of each one. The inner perianth segment of R. jez consists of 3 blue or violet blue (some cases pale) lanceolate segments, each one has 3 main dark blue (or dark violet blue) vines extending along the segment with other 2 short vines on both sides extending from the segment bottom and reach its middle. The middle vine is straight while the lateral two are curved, spaced from it at the segment middle and converging it at both ends. With dark blue (or dark violet blue) fine slashes in all segment area on both faces. The inner face in some cases has dark blue or white color between vines covering its lower half. In general, the outer face of the perianth segment is darker than the inner one. On the other hand, the inner perianth segment of R. lib. consists of 3 white lanceolate segments, each one has 3 main dark blue vines running along the segment; the middle vine is straight while the lateral two are curved, spaced from it at the segment middle and converging it at both ends, on its 2 faces. And with a wide strip of blue or violet blue covers the area between the 3 vines on the external face on the bottom half of the segment length (some are without) keeps white edges around it sum. With pale blue slashes in all segment area on both faces. The differences in the taxonomy of outer perianth segment of both Romuleas reveal the uniqueness of each one. The throat of R. jez. is white or dark blue, stripped and not hairy at all, while that of R. Lib is white and hairy below. The filament in R. jez is white speckled with blue or violet blue, thicker - and might be a little hairy- below while in R. lib it is white. The anther in R. jez is white grooved and stripped on its outer face edges by blue or violet blue (with white pollens), linear sagittate, longer than filament while in R. lib it is pale yellow. The style (at perianth segment) in R. jez. is blue or violet blue (pale on its bottom third), glabrous, grooved, much longer than stamens, bifid on its last quarter in the top to form stigma while in R. lib it is white. It is often that each strand of the stigma in R. jez is striped on its edges by fine dark blue or dark violet blue lines. The flower spathe in R.jez reaches up to the half or more of perianth length (some few cases are less than the half). Finally, each capsule in R. jez. contains up to 24 seeds.

*Romulea jezzini* grows in mixed soil with few stones and high humidity or water-soaked in open, sunny areas and in the western borders of the areas planted with aerial pine, where sunlight reaches it only from afternoon until sunset at an altitude of 1000m to 1100m

above sea level. On the other hand, *Romulea libanotica* grows in mixed soils rich in stones in open mountainous lands devoid of trees, at an altitude of 1400m to 1650m above sea level with varying humidity between low to high. What grows from it at an altitude of 1500m to 1650m have shorter leaves.

## Conclusion

Two new world records *Romulea jezzini* K. Addam & M. Bou-Hamdan sp. nov. and *Romulea libanotica* K. Addam & M. Bou-Hamdan sp. nov. were discovered and joined the Lebanese flora and precisely the Iridaceae family. The validation for the existence of these new species was verified by illustrated morphologic description, more than 22 years of field work and five years of observation, phenology, a host of locations, and voucher specimens (representative dried sample) of the plant which were deposited in K. Addam's Herbarium in Arts, Sciences and Technology University in Lebanon. The existence of numerous quantities of the new species were collected by M. Bou-Hamdan and identified by Khodr Addam.A.

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## Conflicts of interest

The authors declared that there is no conflict of interest.

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