

# International Rock Gardener

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March in the Northern hemisphere suggests that Spring may be in full flower - sadly we cannot guarantee that - but at least there is enough movement in the garden to cheer most northern gardeners.

Matters of the science or practice of classification are the subject for IRG this month. Jānis Rukšāns discusses how best to delineate a *Crocus* species, a subject which he has spent many years addressing. Dimitri Zubov and Leonid Bondarenko describe a new species of stoloniferous *Iris* from Armenia.

Cover photo: *Iris sisianica*

## How to characterize a *Crocus* species? : Jānis Rukšāns, Dr. biol. h.c.

### **Abstract:**

Based on *Crocus rhodensis*, morphological features are compared in wild plants collected at different stages of development and localities with cultivated plants of the same species. Distribution areas of some species are discussed.

The new name, *Crocus yalovensis* Rukšāns was previously published as *Crocus violaceus* (Yüz. & N. Özhatay) Rukšāns.

**Key words:** *Crocus*, Detection, Morphology, Distribution, Taxonomy, *Crocus rhodensis*, *Crocus mawii*, *Crocus violaceus*, *Crocus yalovensis*.

In December 2016 Kerndorff, Pasche & Harpke published an article “The Genus *Crocus* (Liliiflorae, Iridaceae): Taxonomical Problems and How to Determine a Species Nowadays?” (*Stapfia*, 105: 42-50) in which they criticised three of the species published earlier by me. The authors questioned the correctness of the data I had given in the descriptions. I already analysed the situation with *Crocus reinhardii*, when I published *C. inghamii* (*International Rock Gardener*, 89). A repeated checking of the measurements of the flower details in the wild showed quite important differences between the data observed by me at the *locus classicus* and the data published by Kerndorff & al. (2016) from an unidentified locality in the region where the two different, though related, species occur.



Left: *Crocus inghamii* (photo Tamara Galystan) flowers are flamed on segments outside, while flowers of *C. reinhardii*, right, are striped.

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In the aforementioned article H. Kerndorff gives some “rules” as to how a new species must be published, how the data must be gathered, and which data are not usable when describing a new species. From my correspondence with the authors I came to the conclusion that D. Harpke is in charge of the genetic groundwork in their field researches, E. Pasche searches for illustrative material, and H. Kerndorff is responsible for the botanical descriptions (at least all my questions to E. Pasche regarding species were redirected to H. Kerndorff). My apologies, if I am wrong. Taking into account the higher statement, this and further polemic relates to allegations of H. Kerndorff and does not relate to his co-authors – E. Pasche and D. Harpke - whose valued contribution in the criticised articles cannot be doubted.



*Crocus rhodensis* on Rhodos Island

Another species where data were criticised was *Crocus rhodensis*. It was described from the island of Rhodes in 2015. Knowing that every detail was gathered very carefully, I was surprised that the data were rejected by H. Kerndorff (private correspondence). I had observed 30 individuals (as is recommended by Kerndorff & al., 2015); 16 flowers, gathered in the wild, were fixed in herbariums, and everyone can check the correctness of my observations on the holotype and isotype herbarium sheets deposited in Gothenburg and Gatersleben. Fourteen other flowers got damaged during the measuring and were of no use for herbarium; only later I learned a technique of how to conserve flower details in the field for a later research in laboratory conditions. And here comes the question – how to explain the differences in our data?

Therefore I wanted to investigate:

- 1/ how much difference is there in the data collected in the same population in different years?
- 2/ what differs in the data gathered in different populations?
- 3/ how is the gathered data influenced by the blooming time – at the start of blooming, during the culmination, and at the end of flowering;
- 4/ do the data amassed from wild plants vary significantly from the data gathered from cultivated plants?

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With this in mind, in early spring 2017 I, together with 3 friends, revisited the island of Rhodes. We intended to inspect two different populations of *Crocus rhodensis*. One was near Profitis Ilias, the *locus classicus*, where I gathered the data that were later used in the description of the species. When I first collected *C. rhodensis*, it was just the start of blooming, now we were there during the peak; the second population at Kako Vouni was nearing the end. Back at home, I collected and conserved 15 flowers of cultivated plants (I simply collected in the wild only 15 corms, so it was impossible to get data from 30 different plants).

Near Profitis Ilias our team split into three groups and each took a different route: one was taken by two amateur gardeners (my Czech friends Václav Jošt and Jiří Bydžovský) who just enjoy the nature, my Ukrainian friend botanist Dimitri Zubov chose a second track, and I followed the third trail. Before the climb everyone got a small plastic can and was instructed to collect randomly at least 30 flowers along their path, picking the next flower not closer than 10 metres from the previous, in such a way ensuring a truly randomized collection. In total, there were gathered 70 flowers on Profitis Ilias and 30 on Kako Vouni (at Kako Vouni I did not partake in the activity, but engaged myself with the fixing of the gathered flowers on a sticky tape). Thus it was possible to compare differences between two populations visited at different stages of blooming (the peak on Profitis Ilias and the end on Kako Vouni), and to compare individual gatherings because no one is able to avoid unintentional preferences. If a really randomized collection is wanted, plants must be collected without flowers, but then the data can be accumulated only from cultivated plants. All this allowed me to obtain general characteristics of different features and to compare the data with the data from cultivated plants and the data published by Kerndorff & al. (2016).



Above and left:

Fixation of flower details *in situ* on Rhodos Island at Kako Vouni. Photos Dimitri Zubov.



Isotype herbarium sheet of *Crocus rhodensis*.

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Table 1.

Morphology of *Crocus rhodensis*

Origin of sample	Outer segments (mm) length/width ratio	Inner segments (mm) length/width ratio	Filaments (mm)	Anthers (mm) length ratio to filaments	Length of the style branches (mm)	Position of the style regarding the stamen (%)		
						v	=	^
<u>Profitis Ilias</u> 2015 n=30	13-19-29 4-5.5-8 ratio = 3.5	11-17.5-26 5-6.5-9 mm ratio = 2.7	4-5	9-10 (-12) ratio incalculable	Not measured	50	31	19
<u>Profitis Ilias</u> 2017 n=70	14-22.6-30 3-6.6-10 ratio = 3.4	13-20.4-28 3-8.2-11 ratio = 2.5	3-5.3-9	5-9.2-11 ratio 1.7	3-5.3-9	32	43	25
<u>Kako Vouni</u> 2017 n=30	17-21.6-28 4-6.4-9 ratio = 3.4	15-19.7-26 6-7.8-10 ratio = 2.5	3-5.1-8	7-8.9-11 ratio = 1.7	3-4.7-7	40	53	7
Total wild 2017 n=100	14-22.3-30 3-6.5-10 <b>ratio = 3.4</b>	13-20.2-28 3-8.1-11 ratio = 2.5	3-5.2-9	5-9.1-11 ratio = 1.7	3-5.1-9	<b>34</b>	<b>46</b>	<b>19</b>
HKEP n=20-22	18-23.9-28 6-7.9-9 <b>ratio = 3.0</b>	18-22.9-24 8-9.2-11 ratio** = 2.5	4-6.2-9	8-9.8-13 ratio** = 1.6	3-6-11.5	<b>91</b>	<b>14</b>	<b>9</b>
Cultivated plants, 2017 n= 15	18-22.8-27 6-6.6-9 <b>ratio = 3.6</b>	17-21.2-28 7-8.8-11 ratio = 2.4	4-5.7-10	7-9.6-12 ratio = 1.7	3-7-7	27	47	26

\* v - stigma positioned below the tips of the stamens; = stigma equals the tips of the stamens; ^ - stigma longer than the stamens (overtops them) – numbers rounded off.

\*\* - ratio is not published by Kerndorff & al, but can be calculated from the published data.

Profitis Ilias		Cr. rhodensis				
T	Ar	le	fil	Anth	posit.	branch
23	6	21	7	9	=	5
27	7	20	7	10	↑	8
22	7	20	8	9	=	5
18	4	16	5	11	=	5
24	8	21	9	10	=	8
24	5	22	8	8	↑	6
24	8	25	10	9	↑	6
24	6	22	7	10	=	6
24	5	19	6	10	=	5
20	6	19	8	10	=	5
25	7	22	9	11	=	5
19	6	18	6	10	=	6
22	7	20	8	11	=	4
21	5	19	8	9	=	6
27	6	23	8	8	=	6
20	6	18	7	8	↓	3
14	3	13	3	4	↓	4
17	4	16	5	4	↓	6
26	8	24	9	6	↓	6
20	6	20	8	10	=	5
n=20		n=20	n=19	n=19		105
14-27	5-8	13-25	3-10	106	102	5-8
44	12.2	39.8	14.9	5.6	3.6	
22.2	6.1	19.9	7.45			5.4
3.64		2.67		1.71		↑ 3

Data sheet with measurements of flower details collected along search route I on Profitis Ilias. Red circle marks the extreme value of measurements.

The obtained figures clearly show that there are no significant differences between the data gathered in the wild or from the cultivated plants. H. Kerndorff et al. (2016) wrote: "...cultivated plants have in general luxurious conditions. They are fed regularly, enemies are controlled, the substrate is artificially made of several beneficial ingredients, the water regime is controlled, etc. This treatment results in more or less equally strong plants."

This statement is true but only when it is applied to large, commercially grown stocks represented by clones. We all know that nowadays tomatoes, cucumbers, cut-flower roses, gerbera, etc. are grown in substrates based on fiberglass or coconut fibre with computer-controlled watering and fertilisation to ensure maximum yields that really vary little from year to year.

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The situation with wild species in botanical gardens, amateur collections, etc. is completely different. In the wild they suffer or benefit from light conditions, the whims of weather, and nutriment availability in the same way as in culture. H. Kerndorff et al. (2016) stated: "Climatic factors, respectively weather conditions may change from year to year but this has mainly only influence on the flowering time." This is not true. In nature plants are periodically influenced by droughts, night frosts, as well as many other natural factors that affect the growing capacity on a regular basis. As in cultivation, they are not immune against fungal diseases, viruses, pests, not to mention rain, hail, grazing, occasional extra feed from cattle droppings, and hundreds of other causes. Plants that are not cultivated as clones have the same variability of "...growth parameters (size, shape), and different appearance of many individuals are primarily dependent on the genetic potential of the population. This means that even in a permanent change of generations the population with all its (potential) morphological and phenotypic variants stays more or less constant in time" (Kerndorff et al. 2016). The same happens with cultivated plants, as was clearly confirmed by our research on *Crocus rhodensis*.



*Crocus rhodensis*



The statement by Kerndorff et al. (2016) in the previously mentioned article on *Crocus reinhardii* that: "The results show very clearly that all measurements from pot-cultivated specimens are very different to the ones from field studies of wild plants" turned out to be completely untrue. It was based on mixed data of two species published by me (*C. reinhardii* and *C. gunae*), but it seems unnecessary to repeat those arguments here. Everyone can find them in the International Rock Gardener, 89 (2017).

When we work on characterizing a species, observations in the wild are very important, but we cannot avoid the data from cultivated plants – it allows us to compare different species in +/- similar conditions; this also gives us the opportunity to discover those differences between them that can remain obscure in the wild. Just by growing in controlled conditions I was able to clearly separate

two very similar species – *Crocus laevigatus* from the Greek mainland and *C. pumilus* from Crete.

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Even very well-fed plants of the latter never reached the size of *C. laevigatus*. In autumn 2016 on Crete, in a spot richly fertilized by a thick layer of decomposed sheep droppings, I found several huge *C. pumilus* flowers and even there they had remained smaller than the smallest *C. laevigatus* I had seen in the wild.



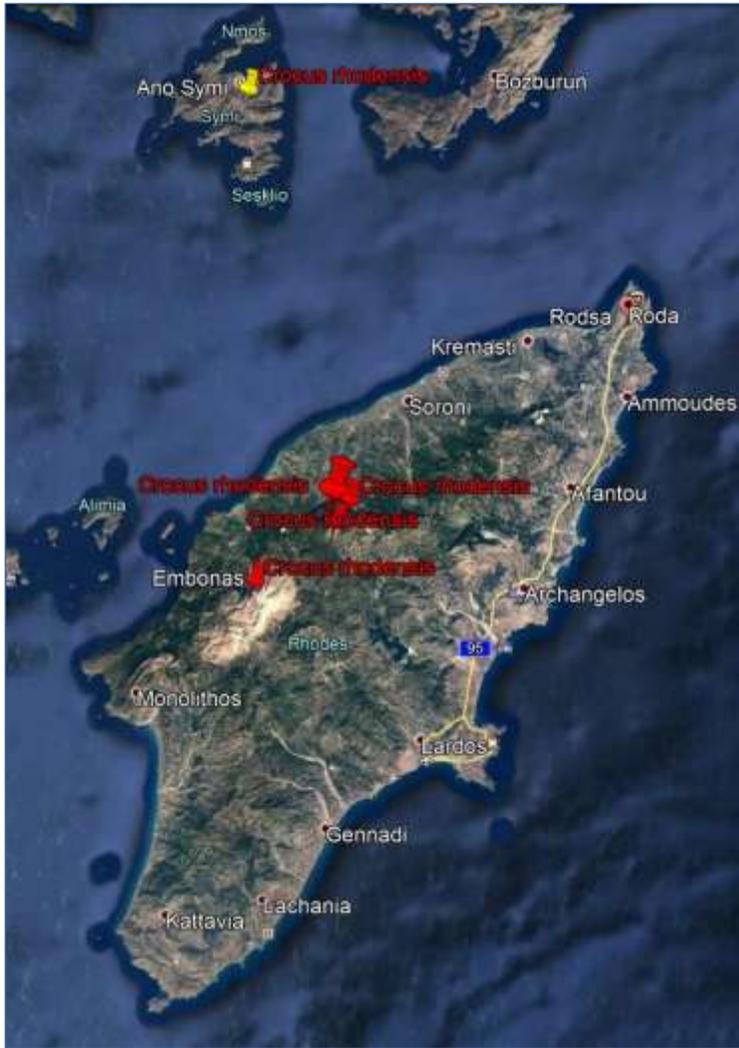
*Crocus laevigatus* flowers on either side, *C. pumilus* flowers in middle.

Blue coloured form of *Crocus rhodensis* on Simi Island. Photo Lyndon Savage.

During our research on *Crocus rhodensis* we found that there were no significant dissimilarities between plants collected in different years and in different populations. The only discrepancies were found in the statistics given by HKEP – in some points they more or less agreed with the data gathered by my colleagues and myself, except in two positions (printed in bold in the tables) where they diverged too greatly to be explained by the variability, and namely: the length/width ratio of the outer segments – there the difference on average was ca. 15 % and the position of the stigma regarding the tips of the stamens. It can only be interpreted as an inaccuracy while taking measurements or as a different approach. Although the position of the stigma regarding the anthers varies considerably from season to season, the differences between my data and that of HKEP were too big to be justified by seasonal variations.



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Map with localities where *Crocus rhodensis* was found.

While analysing individual plants we found that some figures were quite surprising. Especially variable were the ratio between the length of the filaments and the anthers. Although the average numbers were almost constant (in my researches - 1.7, in HKEP - 1.6), there were individuals whose filaments were equal in length to the anthers (index 1.0), while in some others the ratio was 2.75, and in one case even 3.3. The discovery of *Crocus rhodensis* on the neighbouring island of Simi broadened our knowledge about the flower colour in this species. On Simi, alongside white individuals, grew blue ones, too. No blues were found on Rhodes.

A special trip is needed to check the morphology of the Simi population, but that is unfeasible for me at present.

It was interesting to study the scope of variation in the flowers gathered by each collector, thus finding out their individual approach and unintentional preferences. To make the table less complicated I limited the data to only the length-to-width ratios.

Table 2

I - collected by Václav Jošt and Jiří Bydžovský; II - collected by Dimitri Zubov; III - collected by the author.

Table 2 clearly shows that such data as segment width ratio and the length of the anthers and filaments change little and do not differ much regardless of the number of collected plants. In each case there were some instances that fell out of the general scheme, but this can be avoided by excluding the highest and lowest observed values, as is done in some sports, where the highest and lowest

Origin of the sample, collector	Outer segment s length/width ratio	Inner segments length/width ratio	Length of the anthers to the filaments	Position of the style regarding stamens (%)		
				v	=	^
<u>Profitis Ilias, I n=20</u>	3.6	2.7	1.7	26	58	16
<u>Profitis Ilias, II n=20</u>	3.4	2.4	2.0	35	35	30
<u>Profitis Ilias, III n=20</u>	3.3	2.4	1.6	35	35	30
<u>Profitis Ilias, III n=10</u>	3.5	2.5	1.7	30	50	20
<u>Profitis Ilias, III n=30 (20+10)</u>	3.4	2.4	1.7	33	40	27
<u>Kako Vouni I n=15</u>	3.3	2.5	1.6	47	47	6
<u>Kako Vouni II n=15</u>	3.4	2.5	1.7	33	60	7
<u>Kako Vouni I+II n=30</u>	3.4	2.5	1.7	40	53	7
<u>All together n=100</u>	3.4	2.5	1.7	<b>34</b>	<b>46</b>	<b>19</b>

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points given by judges are not counted. Another obvious conclusion is that the position of the stigma and the anthers in each population can be quite different or it can be influenced by the age of the flower. To determine whether the latter plays any role further research must be undertaken comparing the position of the stigma at the start of blooming, during the peak, and shortly before the end. This can be done only on cultivated plants, as no one has time to stay at the same locality and observe the development of the flowers. On Kako Vouni many collected flowers neared the end of blooming and were not usable for measuring, therefore the number was limited to 15 in each collection. Flower parts in crocuses increase in dimensions during the course of flowering, consequently the length/width ratios are more important than the actual mm of each dimension.

In many cases in the publications regarding new species Kerndorff & Pasche (HKEP) state: “known only from a single population... or from the type locality”. In several instances I found those species at different locations not far from the type locality (at least I thought so, as the data about the type localities given by HKEP were as a rule far too approximate or even misleading). On many an occasion these populations displayed greater variability than was mentioned in the papers published by HKEP. Such examples are *C. akdagensis*, *C. katrancensis*, and some others.



Variability of *Crocus katrancensis* JATU-057. All plants were collected from a very small population of just a few sq. m. in size.

When I asked about that, E. Pasche responded that there most likely were growing two different crocus species (private correspondence). Of course, in many localities indeed side by side grow 2-3-4 or even five species, but they all usually are significantly distinct. Coexistence of two very closely related species in a small population, which can be distinguished only by minor details – more variability in colour, the presence of a black shade in the anthers, etc., would be a very exceptional event, and, honestly, pretty improbable. I had an e-mail exchange with H. Kerndorff about the identity of some of the species and he wrote that the identification of a crocus, which I found “near” a type

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locality, was a clever method, but did not work with crocuses. However, if we go in this direction, then we must regard each population as a different species, which is certainly absurd. If we adhere to this point of view, *C. rhodensis* from the island of Simi cannot be regarded as conspecific with the plants from Rhodes, because in this population alongside white individuals were growing blue ones as well, and such a colour is not mentioned in the published type description. Of course, it cannot be excluded that there really are other crocus species, which morphologically look very similar with *C. rhodensis*, but this can only be proved by the analysis of DNA from both islands.

Variability of *Crocus akdagensis* 12TU-021. Plants collected not far from the supposed type locality on a population around few hundred sq.m. in size.



Below: Variability of *Crocus rhodensis* on Simi Island. Photos Lyndon Savage.

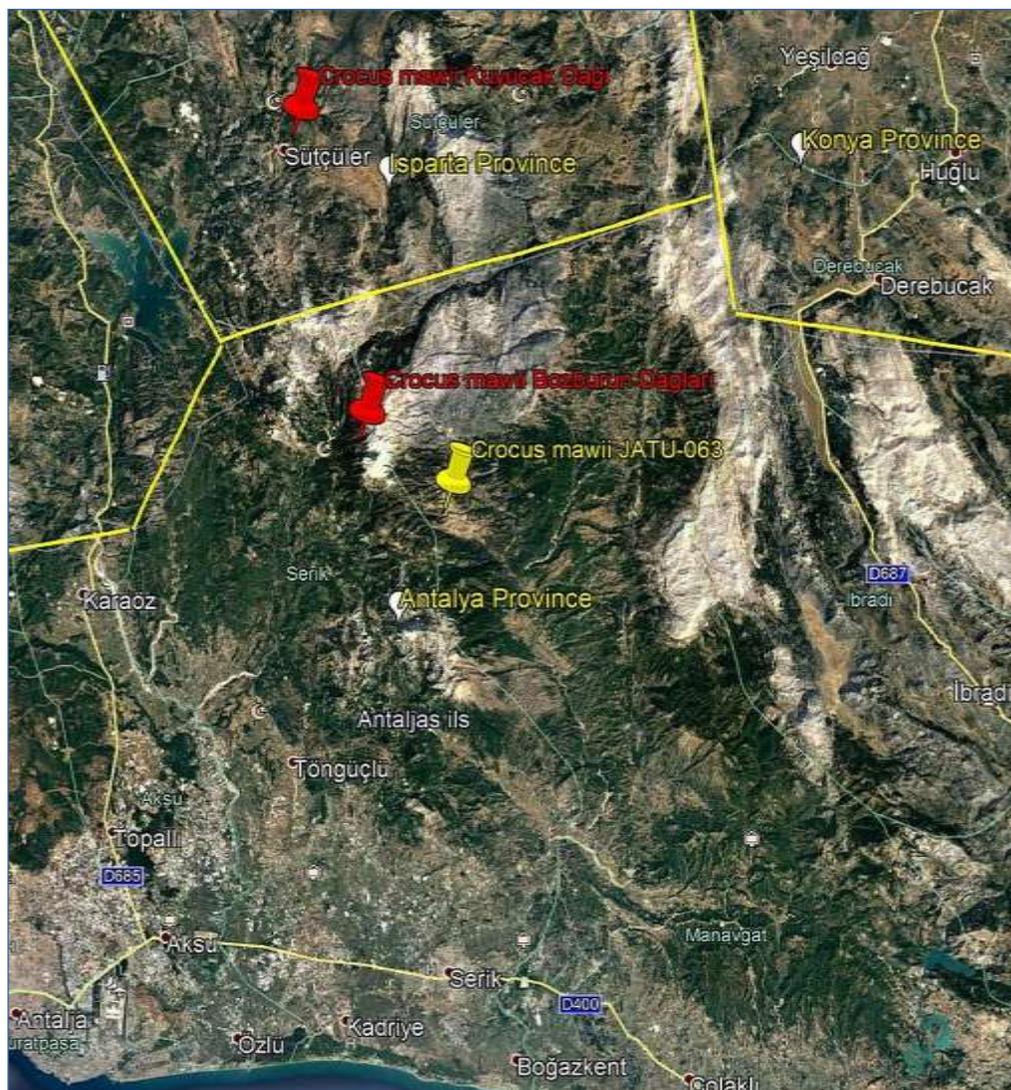


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We discussed the identity of the crocus whose picture was used on the front cover of my book. H. Kerndorff wrote: "But I have to remind you that the front cover of your "encyclopaedia" does not show *C. mawii*... Unfortunately this is not the only case in which you only assume an identity of a crocus which was found by you "near" a type locality of us." This made me check the origin of my plants in my old diaries, looking for the details on the crocus later named by HKEP as *Crocus mawii* and to compare them more carefully with the data on herbarium sheets of *C. mawii* in the Herbarium of Gatersleben.

I agree that the map in my book depicting the distribution of *C. mawii* might be incorrect and it would have been better if it were replaced with a new one, showing the exact localities of HKEP plants (in accordance with the herbarium labels) and my gathering (this certainly will be done in "The First Supplement").

I collected the crocus, which I later identified as *Crocus mawii*, on the 20th of March 2007 and the gathering was labelled as JATU-063. I found it not far from vil. Altinkaya (Antalya Province) on Bozburun Dağları at an altitude of 1100 m (3 years after HKEP) on my way into the mountains through Koprulu Canyon. This site is only 9 km from one of the supposed type localities of *C. mawii*, labelled as - "HKEP 0413, Typus!, Bozburun Dağları 1600 m". However, there is another herbarium sheet with the same acquisition number (HKEP 0413), but on its label is written: "Çobanisa Nord, 2000-2100 m." The plant was identified by D. Harpke. Both localities are separated by 25 km. Bozburun Dağları is located in Antalya Province, Çobanisa – in Isparta Province. It is very strange that the same acquisition number is given to plants collected in around 25 km distance and in different provinces.



Distribution map of *Crocus mawii* - red marks - HKEP localities, yellow mark JATU-063 locality, yellow lines - approximate province borders.

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Variability of *Crocus mawii* JATU-063.

However, this is not the only incongruity with the publication of *Crocus mawii*. When we read its official publication in Stapfia, 99 (2013) we learn that the type locality of *C. mawii* (HKEP 0413) is Kuyucak Dağı in Konya Province. Çobanisa village really is located near Kuyucak Dağı, but, alas, there is no Kuyucak Dağı in Konya Province. The mountain ridge that separates Konya Province from Antalya and Isparta provinces is Dedegöl Dağları, and the nearest border with Konya Province is located at least 30 km to the east from both locations mentioned on the herbarium sheets. *C. mawii* is not the only species described by HKEP that provokes questions about the correctness of the published data. For example, in Fig. 2 (map) in Kerndorff et al. article in Stapfia, 99 (2013), the location of *C. ponticus* (type collection HKEP-0621) is marked near the locality of the *C. tauri* epitype (HKEP-0929) – 400 km from the exact place of *C. ponticus* (if the data about its *locus classicus* is correct). This might be an oversight during the preparation of the map, when a wrong number was put near the spot with “0621”, but at the same time there is no marking indicating the possible locality of *C. ponticus* (according to its description). The closest marks for the related acquisitions 1016 and 1018 (the latter in Table 1a is named as *C. aerius*, in the description of *C. ponticus* it is listed with no name, but in Stapfia, 107 – as *C. aerius* aff.) are in ~ 150 km distance from the supposed *C. ponticus* locality. Other nearest marks (1019, 0618, 1036, 1037) indicate the genetically dissimilar *C. adamii* group. Several other discrepancies I have already mentioned in my book (Rukšāns, 2017). Nevertheless, there naturally arises the question of how the mistake with the *Crocus mawii* distribution map came about. In my collection there are still more than 50 unidentified crocus samples that

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represent the so-called "*C. biflorus*" complex. Every time, when a new species is published, I check and compare my data with that of the newly published species, and sometimes my samples get names. In December 2013 Eric Pasche sent me a seasonal greeting card with an image of several flowers of *C. mawii*. It was the same picture that illustrated *C. mawii* in Stapfia, 99 (p. 148, fig. 1a). The flowers looked very similar to several of my gatherings from the localities close to the border between Antalya and Konya provinces, NNW of Akseki. By the way, this is a very famous crocus place where some of the most beautiful Turkish crocuses grow, and I cannot suppose that the two explorers have never visited this locality.



*Crocus mawii*: left - fragment from a greeting card with *C. mawii* sent to author by Erich Pasche, right - plant collected by author (JATU-063).

*C. concinnus* JATU-064 - single real difference between both species is hidden in filaments.

When I compared my plants with the descriptions given by HKEP, I considered two possibilities: *Crocus mawii* and *C. concinnus*. The differences between the two species were minimal and were mostly either overlapping or dependent on the interpretation. There was only one morphological feature that allowed to separate them – the filaments, which in *C. concinnus* were papillose (or hairy - J.R) and nude in *C. mawii*. However, there are places in this region where you can find plants with both types of filaments. If my focus had been on those crocuses, I would have regarded both species as conspecific. Morphologically they are very similar and just the occurrence of my plants along the

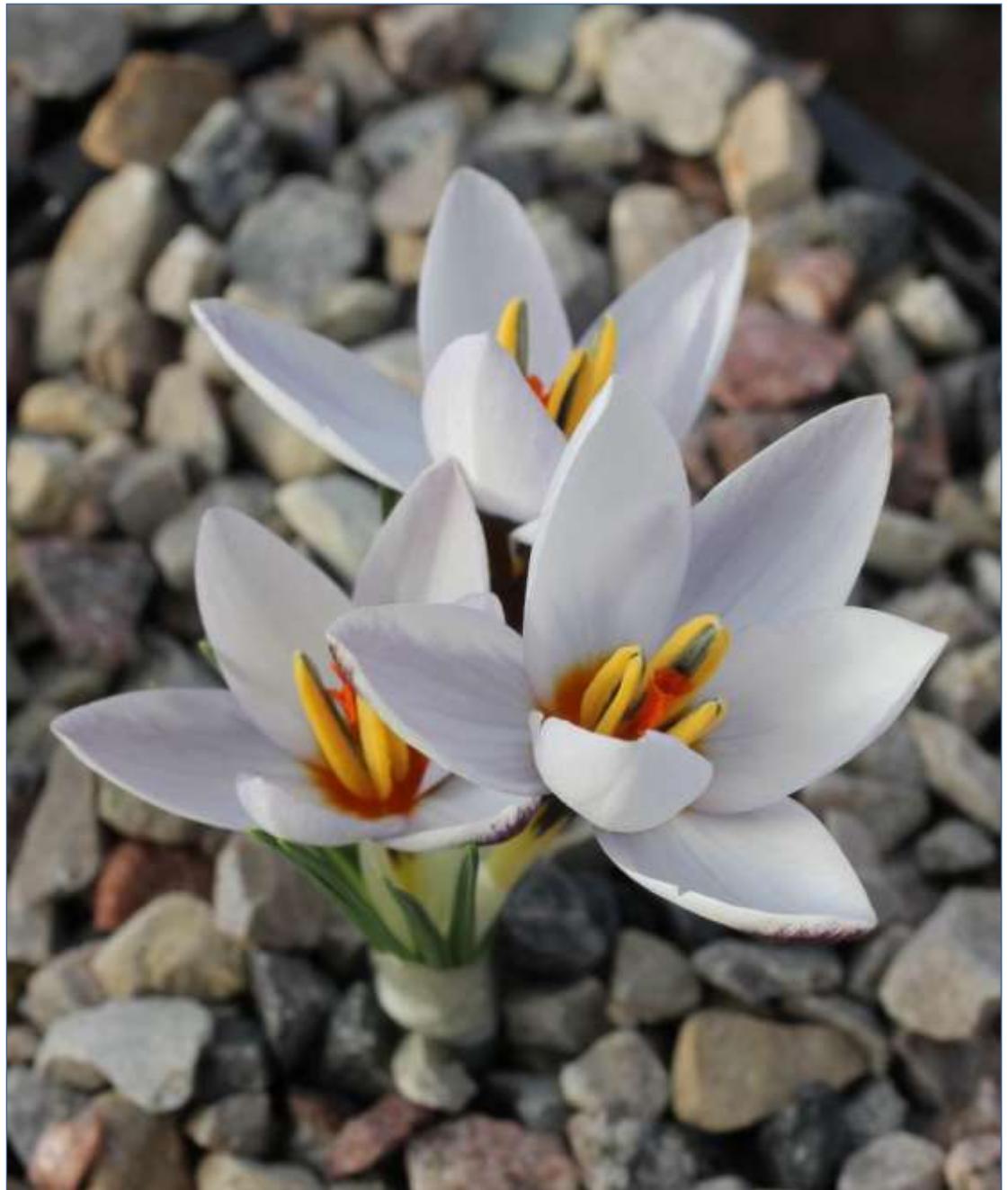


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border with Konya Province pushed the balance in the direction I had taken when I prepared the map for *C. mawii*. I simply did not check at that moment where JATU-063 had been collected.

Crocus sample JATU-063 was identified as *Crocus mawii*, too. It was collected (around 10 corms) at the very end of blooming, so it was impossible to judge the variability in situ - but when the corms flowered in my collection, they turned out to be quite variable and just from them was selected the white-flowering individual on the front cover of my book. I do admit that it is not the most typical representative of *C. mawii* - its stigma ends below the tips of the anthers, but this has been the case with 27% of *C. mawii* plants observed by HKEP.

Albino of *Crocus mawii* JATU-063 used for front cover of my book. On the picture, left below, it is marked with white stick when it bloomed for the first time.



Although the style branches are characterised by HKEP as “often tight together like an undivided style” (similar to those in my picture), in the illustration in *Stapfia* they all are distinctly divided, as it is in most of plants collected as JATU-063. So it is only natural that my gathering was identified as *C. mawii*. It was never guided by the desire “to quickly increase your catalogue with new and expensive rare taxa without work but, on the other hand, your customers are cheated because they pay for wrongly determined plants like “your *C. mawii*”” as was declared by H. Kerndorff in his letter to me.

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H. Kerndorff et al. (2016) write: "the origin of the species plays now a much more important role than ever before, as many species are known now to be confined to rather restricted areas. Actually all these facts have to be considered now when determining a crocus." Unfortunately, they themselves almost never follow this very rule when publishing new species.



*Crocus iranicus* WHIR-163 -21



*Crocus iranicus* aff. from Giessen B.G.



*Crocus iranicus* WHIR-163 basal rings



*Crocus iranicus* aff. Giessen, corm tunic basal rings

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We all make mistakes; no one is safe from them. When I published *Crocus iranicus* (Rukšāns, 2014) under this name I included also a picture of a plant grown in the Gothenburg Botanical Garden that had originally arrived from Giessen Botanical Garden in Germany (Botanischer Garten der Justus-Liebig-Universität Gießen ) with no information about its place of provenance (just “from Iran”), although it had different looking basal rings. This mistake was repeated in my crocus book (Rukšāns, 2017). *C. iranicus* was described at the very start of a comprehensive research on Iranian crocuses, when very little was known about the variability and the presence of many different crocus species with “annulate” corm tunics in Iran. According to Flora Iranica (1975), at that time only two spring-blooming species with this type of tunic were known in Iran – *C. almezensis* with yellow and *C. biflorus (adamii)* with white-blue flowers. So I assumed that the crocus from Giessen whose flowers looked very similar to those of *C. iranicus* was conspecific with it. Now, after the field researches carried out by Kerndorff & Pasche and by me (Kerndorff et al., 2017; Rukšāns 2014, 2017), we know that there are many more species with “annulate” tunics in Iran, though a lot of research must still be done to get more or less complete idea on the diversity of Iranian crocuses.

Turkish botanists upgraded the blue form of *Crocus pestalozzae* as subsp. *violaceus* Yüz. & N. Özhatay (2014). Although widely cultivated (more than its white-blooming type subspecies) it is very rare in nature, growing in a well-separated area and in completely different ecological conditions. Taking into account the special ecology and morphological features, I raised its status and in my book (Rukšāns, 2017) named this crocus as *C. violaceus* (Yüz. & N. Özhatay) Rukšāns.

At that time I did not know that the name *C. violaceus* had already been used in 1771 by Weston (Bot. Univ. 2: 238) and as *C. violaceus* (Boiss.) Bornm. nom. illeg. (World Checklist of Selected Plant Families - WCSP). In both cases this name most likely was applied to the crocus that later was published as *C. adamii* J. Gay (Bull. Sci. Nat. Géol. 25 (Mem.): 319; 1831) – now an accepted name; even though the epithet *violaceus* had been given to this crocus earlier, it was rejected by C. Innes (The World of Iridaceae, 1985) – cited from the WCSP. It is practically impossible to identify the species, for which Weston used this epithet, but the name was already used, so, according with International Code of Botanical nomenclature, *C. violaceus* (Yüz. & N. Özhatay) Rukšāns needs a new name. I decided to name it after Yalova Province where it occurs in the wild.

*Crocus yalovensis*  
Rukšāns –  
formerly  
*C. violaceus*





*Crocus yalovens* Rukšāns – formerly *C. violaceus*

***Crocus yalovens* Rukšāns. nom. nov.**

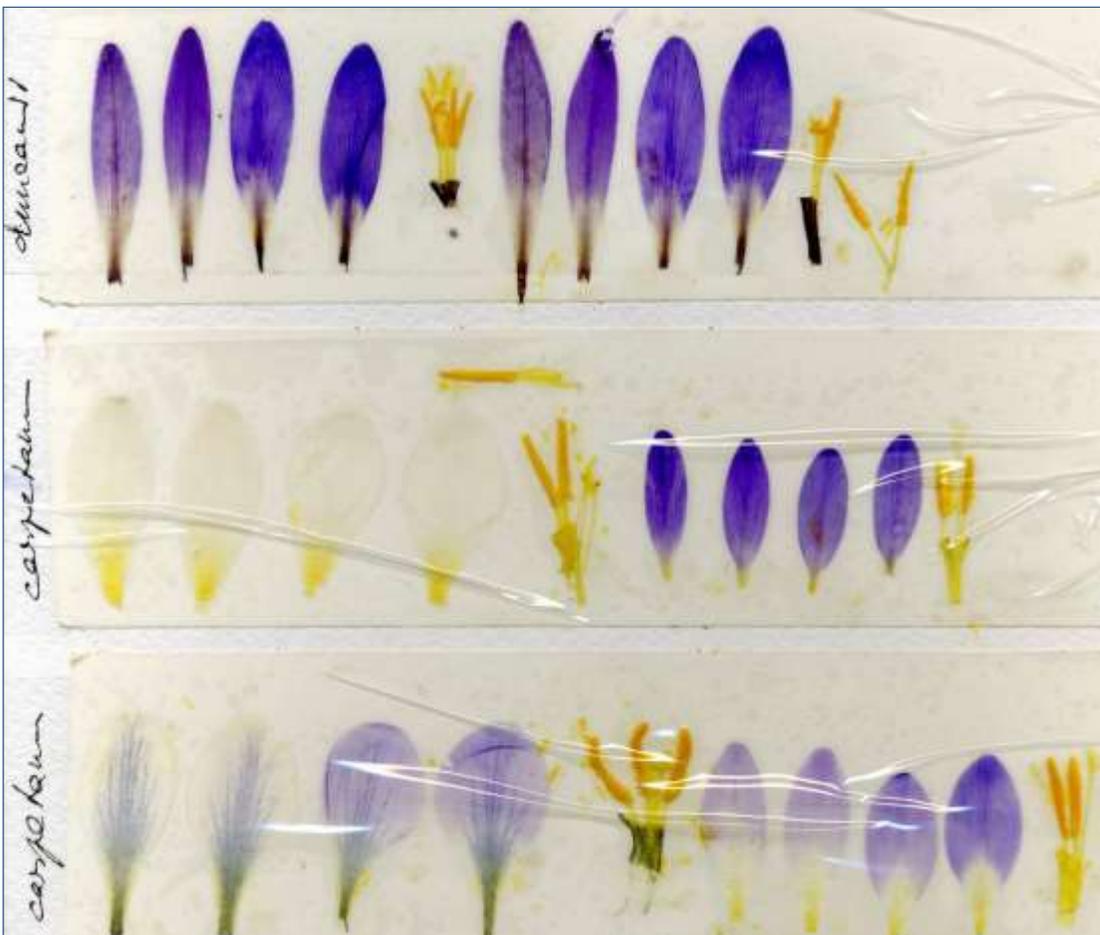
Basionym: *Crocus pestalozzae* Boiss. subsp. *violaceus* Yüz. & N. Özhatay. Phytotaxa 174 (5): 279-284 (2014). Type: Turkey, Yalova: Çınarcık, Delmece Plateau. 28.04.2004, Holo: ISTE 96939. Iso: ANK, NGBB. Ic: l.c. Fig 1.; B. Mathew. Crocus, pl. 51 as *C. pestalozzae*; J. Rukšāns. Crocuses, pl. 131 as *C. pestalozzae* blue form; J. Rukšāns, The World of Crocuses, p. 527, 528 as *C. violaceus*.  
Synonyms – *C. pestalozzae* Boiss. var. *caeruleus* Barr., *C. violaceus* (Yüz. & N. Özhatay) Rukšāns.

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The number of published crocus species has risen enormously. As I have already noted, I still have more than 50 unidentified crocus samples. Many of them look very special and could be published without much dispute. The significance of minor details has soared and the job done by Kerndorff & al. (2015) in the characterization and classification of morphological features in the genus *Crocus* is of the highest value.



Most likely a new species from Iran - 17IRS-053



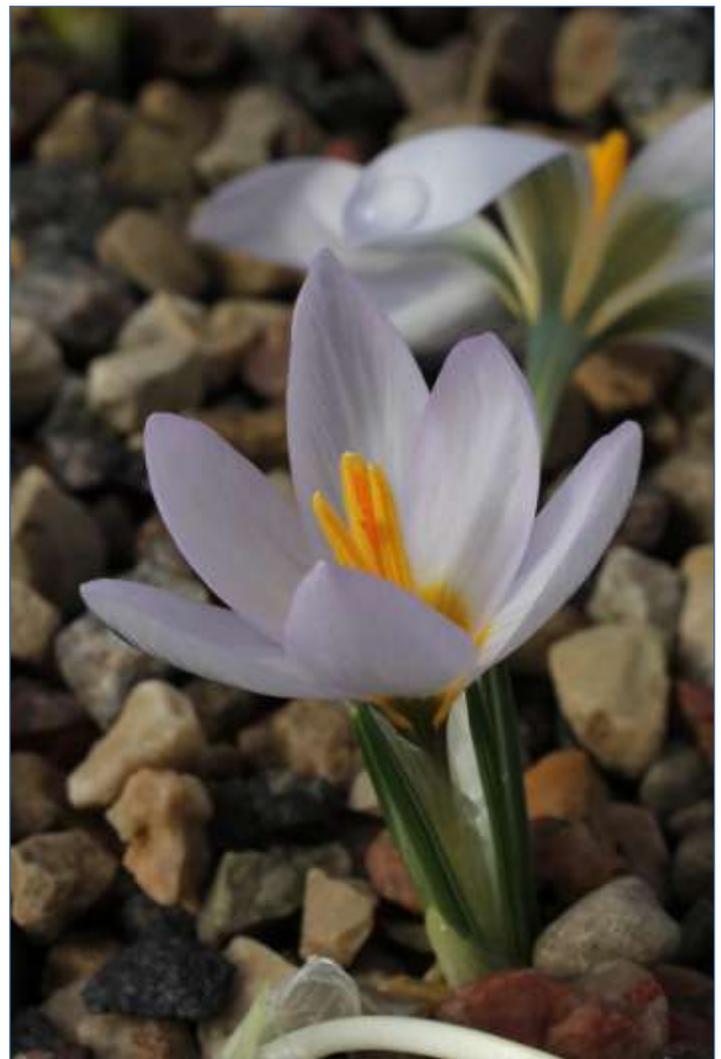
Left: On the top row are samples of *Crocus duncanii* from 2 localities, segments length/width index ~ 4.4, two bottom rows - samples of *C. carpetanus* from 4 localities, the length/width index in slimmest flower (sample #2) only 3.3.

This discussion only confirms the fact that we must be very scrupulous when publishing new species. I do not think that plants which are morphologically inseparable are worthy of their own names, even if genetically they seem

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different, especially if the dissimilarities are very subtle. At the same time, morphologically very different populations with well-defined areas, regardless of their genetic similarity or even identity (at the present level of knowledge), need individual names, as is the case with *C. carpetanus* and *C. duncanii*.

Maybe we simply are not looking in the right place in their genome, where their uniqueness is hidden. The complexity of the situation is well illustrated in a recent publication by Kerndorff et al. (2017) where D. Harpke states: "It is therefore surprising to find *C. gunae* Rukšāns to be molecularly identical to *C. zagrosensis*, growing 650 km away from each other." I have not seen a living *C. zagrosensis*. Pictures of *Crocus zagrosensis* may be seen in [Stapfia 0107 here](#), on Fig.3 as 1637 (1-4). In the pictures it looks quite similar to *C. gunae* published in 2014. Comparison of their descriptions reveals that they can be separated by the number of ribs in the lateral channels of the leaves. Frankly speaking, I don't understand why a morphologically distinct but genetically identical pair of *C. gunae* and *C. zagrosensis* are regarded as different species, but the similarly genetically identical and not less morphologically distinct pair of *C. carpetanus* and *C. duncanii* are not (Kerndorff et al., 2016). I admit that I am not a geneticist and therefore am in no state to judge such nuances. I am simply an ordinary gardener with an inclination for botany.



*Crocus gunae* in the wild and as a cultivated plant.

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And I am especially thankful to my family and my wife Guna in particular, for the hard work at the nursery during my absence while in the mountains.

J. R.



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## ---Species Description---

### ***Iris sisianica*, a new stoloniferous species (*Hermodactyloides* section, *Iridaceae*), described from Zangezur floral area, Armenia**

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#### **Abstract**

*Iris sisianica*, a new stoloniferous species narrowly local endemic to Syunik region, Zangezur floral area, Armenia (Lesser Caucasus) is described and illustrated. Morphological differences between the new species and the closely related species, *I. reticulata*, are discussed. The illustration, photographs, distribution map and conservation status are provided. It is considered as 'Critically Endangered' and known to exist at only a single location (CR B2a).

**Key words:** Armenia, Zangezur floral area, bulbs, stolons, irises, *Hermodactyloides* section, chestnut soils, monophyletic lineage.

#### **Introduction**

The genus *Iris* L., 1753, is a largest genus of geophytes and rhizomatous ornamental perennials of the *Iridaceae* Juss. family, consisting of about 300 species. Irises are common to temperate and arid climates of Northern hemisphere zones from Europe to Asia and within North America [9, 10, 17]. At different times, the prominent botanists W.R. Dykes, J.H.M. Lawrence, G.I. Rodionenko, J.L. Taylor, B. Mathew and C. Wilson have studied the biology, taxonomy, chorology and phylogeny aspects of the genus [3, 8-10, 14-17]. The latest taxonomic and generally accepted systematics are presented in the revision monograph of Brian Mathew, 1989, which also basically formed The Species Group of the British Iris Society account [9, 15]. According to Mathew's treatment, the genus *Iris* includes the following six subgenera: *Iris* B. Mathew, *Limniris* (Tausch) Spach, *Nepalensis* (Dykes) Lawrence, *Xiphium* (Miller) Spach, *Scorpiris* Spach, and *Hermodactyloides* Spach [9].

Actual *Iris* classification is built on the morphological traits such as root system type (e.g., rhizomes, corms, bulbs, tubers, as well as the stolon-like rhizomes, bulb-like rhizomes and tuber-like rhizomes), seed coat structure (with or without an aril), type of sepal crests (ridges), and the presence/absence of sepal beards. But they are not the exhaustive features for the subgenera and sections segregation within defined irises groupings [17].

Currently, four sections belong to the subgenus *Hermodactyloides*: *Brevituba* Mathew, *Monolepsis* (Rodion.) B. Mathew, *Hermodactyloides* Mathew and *Micropogon* Mathew [7].

In turn, *Hermodactyloides* section, according to B. Mathew, 1989 [9], consists of 9 species, (actually 10 species, including the newly described from Armenia *I. sisianica* Zubov & Bondarenko), such as *I. bakeriana* Foster, *I. histrio* Reich., *I. histrioides* (G.F. Wilson) Arnott, *I. reticulata* Bieb., *I. sopenensis* (Foster) B. Mathew & Güner, *I. tuberosa* L., *I. vartanii* Foster, *I. winogradowii* Fomin, and *I. zagrica* Mathew & Zarrei.

#### **Materials and Methods**

Field studies of *Iris sisianica* were undertaken in Armenia in May 2013. Herbarium specimens of *I. sisianica* were examined at the herbaria of WI and KWHA (abbreviations after [5]); living material of

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this species was examined by us *in situ* and in cultivation between 2013 and 2018. Measurements, colours, and other details given in the descriptions are based on living material, spirit and herbarium specimens and data derived from the field notes. Morphological observations were made using Stemi 508 stereo microscope (Carl Zeiss, Germany). Morphological terminology follows [2]. Distribution map was plotted using specimen collection coordinates and carefully verified and error-corrected with Google Earth Pro (7.3.0.3832 (32-bit); ©2017 Google). The map in Figure 4 was produced using SimpleMappr [12]. The conservation status of *I. sisianica* was assessed using the Red List Category (Version 3.1: IUCN 2001) [1, 6].

### Taxonomic Treatment

*Iris sisianica* Zubov & Bondarenko *sp. nov.* (Figs.1,2 &3)

**Holotype:** – ARMENIA: border between cultivated field and dry steppe plots around Sisian, chestnut soils, appr. 1600 m, Sisian Basin, Syunik region; coll. in fruit by Zubov & Bondarenko, 08 V 2013 (holotype WI P33602; isotype KWHA).

**Diagnosis:** – the new species is unique in the genus and differs from close related *I. reticulata* by the mother (main) one-scaled bulb forming extending stolons (stoloniferous one-scaled bulb) ending up with small-sized daughter bulbs. – *I. sisianica* a *I. reticulatae* *bulbis stoloniferis (nec bulbis sine stolonorum)* differt.

**Bulb**, elongate-rounded, consists of one fleshy scale, up to 3.5 cm long and up to 1.7 cm in width, covered with dry netted-fibrous greyish-cream outer scales; mostly with 1-3 thin stolons up to 10-23 cm long with reduced colourless clasping sheaths, or lower leaves (up to 5 on a stolon, up to 0.9 cm long) ended up with a daughter unequally rounded bulb (bulbil) with a pointed apex (up to 1.4 cm wide and 1.7 cm long). Stolons branch out from the basal plate of a mother bulb; very rarely main bulb possesses 1-2 stolonless daughter bulbs; the root initials are numerous, thin, unbranched, up to 6-11 cm long.

**Stem**, short and reduced at flowering time (underground), one-flowered, with lower leaves, after flowering develops to 7.7-9.4 (-11.4) cm high; brownish with dark-purple longitudinal strips.

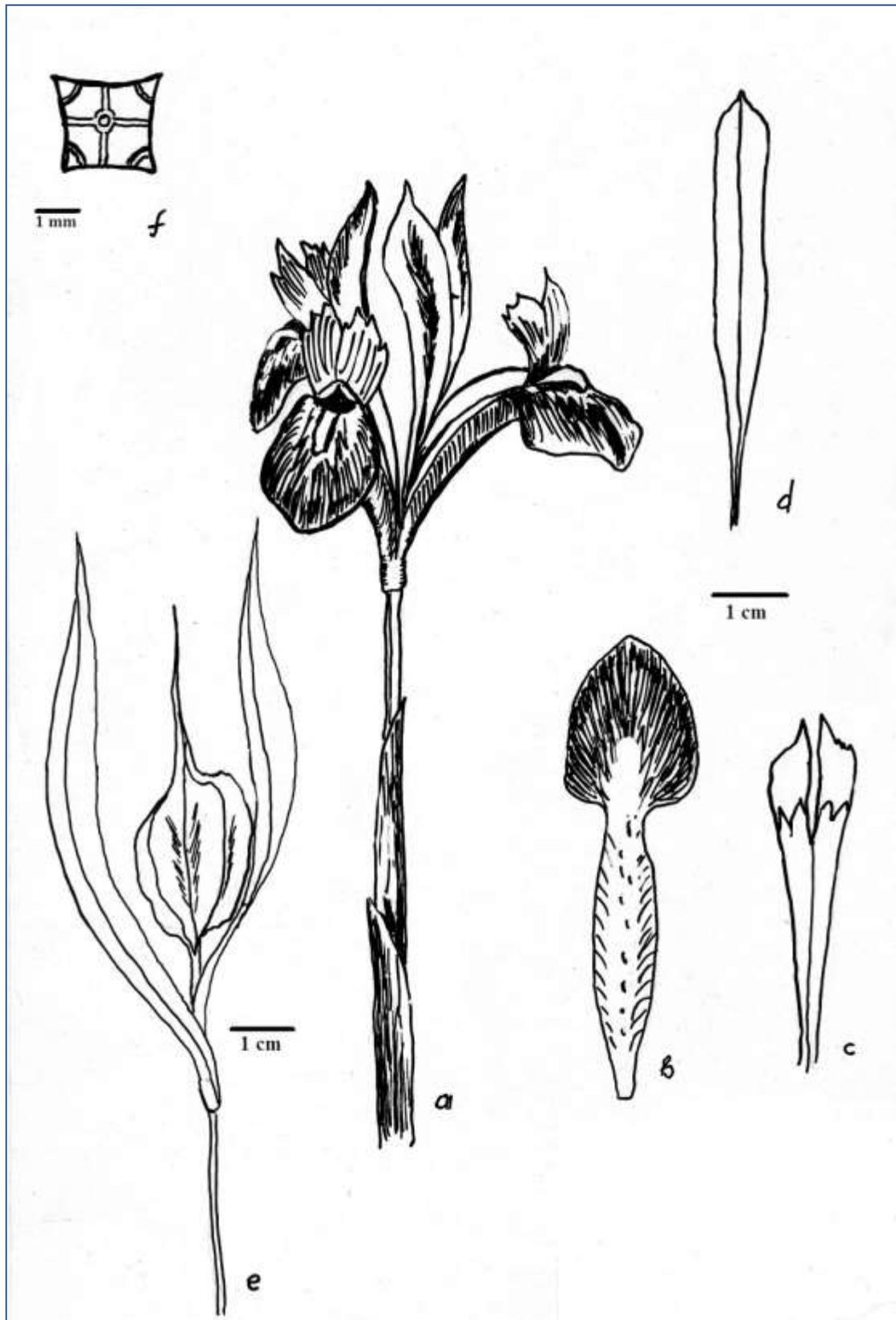
**Leaves**, 2, erect, hollow, unequally quadrangular in section, with white pointed apex (in the middle part up to 2.7 × 2.5 × 2.5 × 2.5 mm in section), up to 1.5-2.5 mm wide and 35-45 (-60) cm high at fruiting, in lower part and along the stem covered with numerous colorless spathe valves (up to 5 per stem) up to 6.6-9.7 cm long and 0.3-0.5 cm wide. The bracteoles are 2, at the base of the flower, membranous and significantly exceeding the ovary (1:2-1:3).

**Flower**, single, relatively large, with a red-purple six-part corolla-like perianth, with a long (up to 5-11 cm) perianth tube; *the inner segments (petals, or standards)* erect, equally long with the outer ones, slightly waved at margins, up to 6 cm long and 1.1 cm wide, narrowly inversely-lanceolate, with a long narrow nail, concolor both sides; *the outer segments (sepals, or falls)* expand from their narrow upturned base, or claw, into the broadly lanceolate drop-down blade, up to 5.6 cm long and 2.3 cm wide, from the base to mid blade bearing a small orange longitudinal ridge (crest) surrounded by a pattern of white and dark purple strips/strokes/dots adaxially; abaxial side widely yellowish with longitudinal red-purple strips, expanding from center to the upper mid bend and margins; *style* divided to the base into three petal-shaped lobes up to 5.5 cm long and 2.4 cm wide each and ended by bi-lobed reflexed stigma at apex; *anthers* linear, up to 1.0 cm long, attached to the filaments (up to 1.5 cm long) with their base and facing the sacs outward.

**Ovary**, inferior, three-loculed, cylindrical, with numerous ovules in each locule; the fruit is a trihedral locusticidal capsule, short to elongated-cylindrical, up to 2.1-3.0 (-3.7) cm long and up to 1.2 cm wide, with a considerable tube at the tip up to 2.0-5.4 cm long.

**Seeds**, 4-8 per capsule, large, rounded, with greyish-brown seed coat and terminal aril, up to 0.5 cm long and 0.3 cm wide when dried.

**Chromosome number:** unknown.



**Figure 1.** *Iris sisianica* (a-f: from Zubov & Bondarenko; by Leonid Bondarenko). a. Scape with a flower and lower leaves; b. Outer perianth segment (fall, abaxial view); c. Petal-shaped lobe ended by bi-lobed stigma at apex of a three-lobed style (abaxial view); d. Inner perianth segment (standard, adaxial view); e. Developed after flowering scape with a seed pod and bracteoles; f. Cross-section view of an unequally quadrangular leaf blade. Scale bar: a-e – 1 cm; f – 1 mm.

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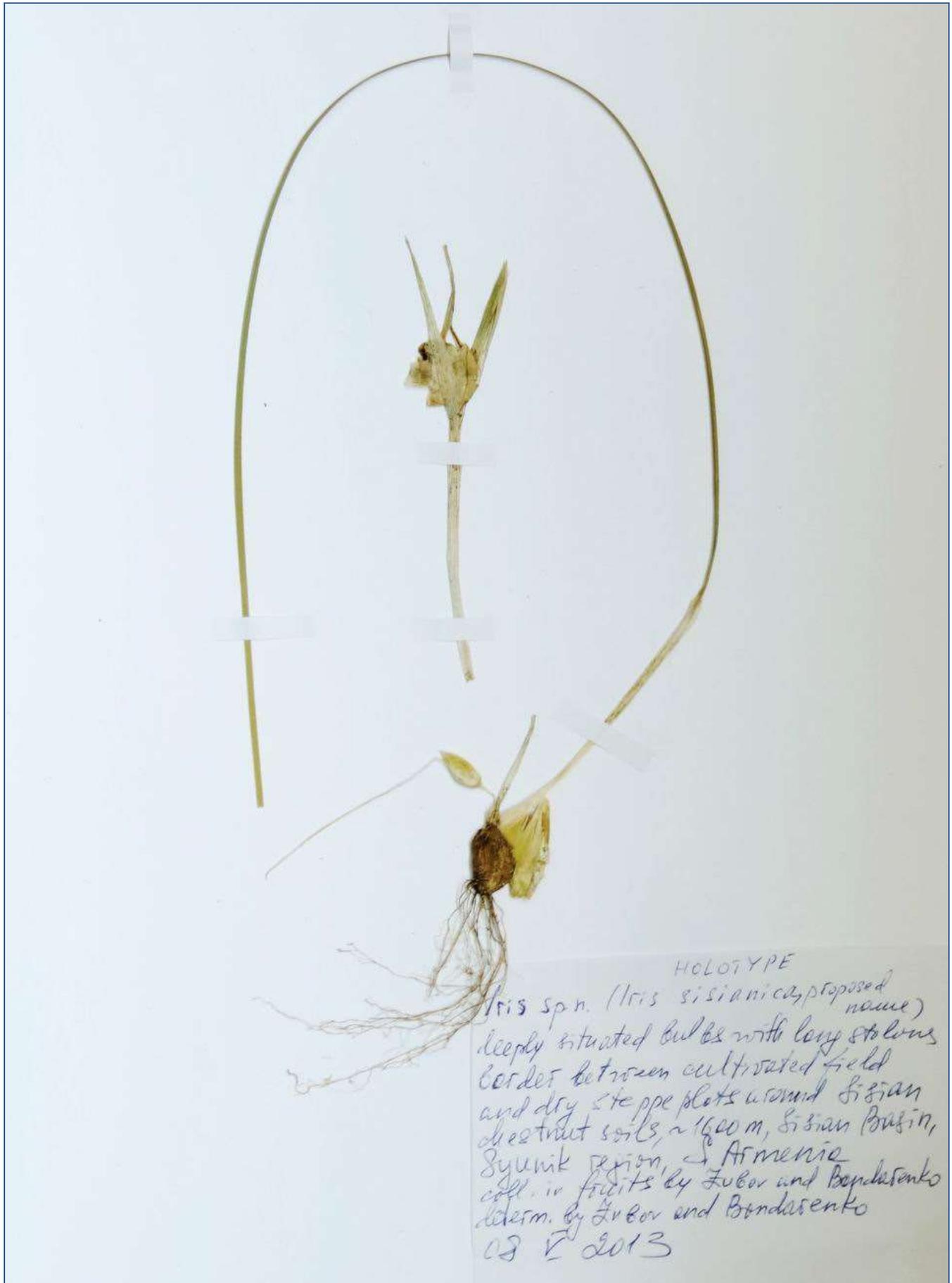


Figure 2a. *Iris sisianica* Holotype WI P33602 housed at Herbarium of the Vilnius University, Lithuania.

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Figure 2b. *Iris sisianica* type and living plants: Freshly collected seeds.



Figure 2c. *Iris sisianica* living plants: Cultivated plants flowering in Ukraine.



Figure 2d. *Iris sisiaunica* living plants: Cultivated plants flowering in Lithuania



Figure 3a. Stoloniferous bulbs of *Iris sisiaunica*: Mature bulbs as lifted from soil.



Figure 3b. Stoloniferous bulbs of *Iris sisiaunica*: View of fruiting plants.

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Figure 3c. Stoloniferous bulbs of *Iris sisianica*: *I. sisianica* mother (main) bulbs with thin stolons terminated by daughter bulbs; *ex locus classicus* (left), and *I. reticulata* mother (main) and daughter bulbs (right); Vanadzor, N. Armenia.

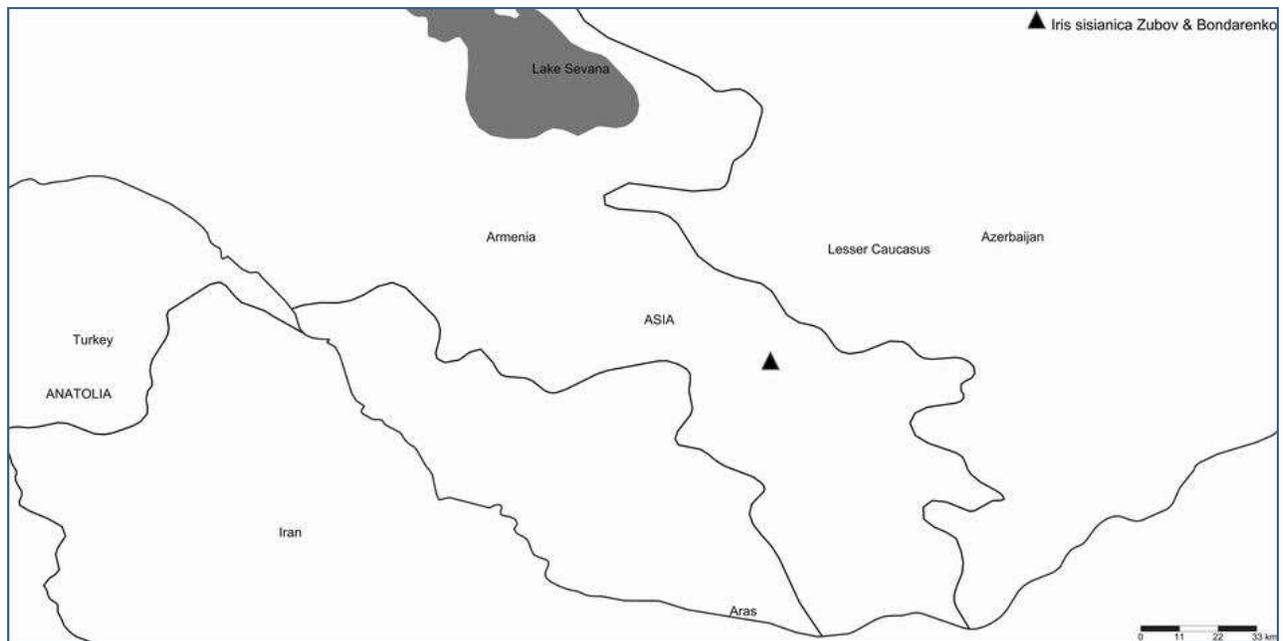


Figure 4. Distribution of *Iris sisianica* (▲) based on collection localities.

Distribution: – Lesser Caucasus, Zangezur floral area (Sisian Basin – Syunik region); a narrowly local Sisian Basin endemic (Fig. 4, above).

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**Habitat and Ecology:** described from the border of cultivated field and dry steppe plots at appr. 1600 m elevation, accompanied by the mid-spring synusia species: *Amygdalus nana* L., *Colchicum trigynum* (Steven ex Adam) Stearn, *Iris caucasica* Hoff., *Leopoldia caucasica* (Griseb.) Losinsk.; growing on chestnut soils of the dry steppe belt of Armenia (1250-1950 m), characterized by average content of humus 2-4%, stoniness, the presence of partially cemented and significant illuvial-carbonaceous horizon, have a slightly alkaline reaction (pH=7.4-8.5). Heliophyte, mesophyte.

**Phenology:** Flowering: March-April; fruiting period: May.

**Specimens examined:** – Lesser Caucasus: **Armenia** – Sisian vicinities, 1600 m, 08 May 2013 (fr.), Zubov & Bondarenko s.n. (holotype: WI P33602!; isotype: KWHA!).

**Conservation assessment:** Considered 'Critically Endangered' (CR; Version 3.1: IUCN 2001). CR B2a: CR – A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (e.g., B criterion), and it is therefore considered to be facing an extremely high risk of extinction in the wild; B2 – Geographic range in the form of area of occupancy (AOO) estimated to be less than 10 km<sup>2</sup> (AOO for *I. sisianica* – 7.07 km<sup>2</sup>), and estimates as: – a. Severely fragmented or known to exist at only a single location (*Iris sisianica* is known from only one location based on one user point).

## Discussion

In May, 01-12, 2013, we made an expedition to Armenia with the aim to explore the snowdrop populations and to delimit finally *Galanthus lagodechianus* Kem.-Nath. (synonyms: *G. artjuschenkoae* Gabriëljian [nom. illeg.], *G. cabardensis* Koss, *G. kemulariae* Kuth., and *G. ketzkhovëlii* Kem.-Nath.) distribution in Armenia, as D. Zubov et al. are studying the phylogeny and micro-evolutionary divergence of the genus *Galanthus* L. [11, 18, 19]. There, in the area of the city of Sisian (Syunik region of Armenia) in dry steppe slopes along the border of the cultivated field, we noticed the leaves and seed pods of *reticulata*-type iris. *Amygdalus nana* L., *Colchicum trigynum* (Steven ex Adam) Stearn, *Iris caucasica* Hoff., *Leopoldia caucasica* (Griseb.) Losinsk. were also dominant in the mid-spring synusia (Fig. 5). The iris plants were in the fruiting phase and were tentatively identified by us as *I. reticulata* aff. However, when collecting the herbarium material, we immediately noticed the presence of small sized bulbils which were on the end of the thin threadlike stolons going out of the basal plate of a mother bulb, which was extremely atypical for true *I. reticulata* bulb structure. As it is known, *I. reticulata* distribution is prevalent throughout the Caucasus (E Caucasus; C, W, E, SW and S Transcaucasus; Talysh-Zuvand), E Anatolia (Turkey), Iranian Plateau and Alborz mountains (NE Iraq, N and W Iran) [4, 13]. According to the genus *Iris* treatment in Flora of Armenia (vol. 10, 2001) made by Eleonora Gabriëlyan, it is distributed elsewhere in Armenia from northern to southern floral areas [4, 13]. However, individual plants of *I. reticulata* collected earlier in the north part of Armenia (Vanadzor vicinities, Lori Province), were typical, represented by the maternal bulb and multiple stolonless daughter ones around its basal plate (Fig. 3c). Such a stoloniferous habit of a true bulb phenomenon is not characteristic for any known species from *Hermodactyloides* section as well as for other true bulb irises actual groupings (subgen. *Scorpiris*, *Hermodactyloides* and *Xiphium*). Of note, it was found in one phylogenetic study by C. Wilson, that the type of geophytic organ in irises is useful in defining monophyletic groups and that the irises ancestral organ type is likely to be the rhizome, but not a bulb [9, 17]. When *Iris sisianica* was flowering in cultivation in 2014-2017 at the garden site in the vicinities of Vilnius (Lithuania) and in Donetsk (Ukraine), all plants were uniformly coloured, being deep red purple and maintaining this stoloniferous bulb pattern.

In conclusion, we are still in hope to make phylogenetic analysis of our new taxon described here to see its exact position by nuclear and plastid datasets within other actually known members of *Hermodactyloides* section. Moreover, as Carol Wilson states in her paper [17], the DNA sequencing datasets potentially can resolve relationships within *Iris*, and she has revealed that some of the subgenus, section and series artificially assembled and currently recognized groups are really not

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monophyletic, according to her studies. In other words, the morphological traits that have historically defined groupings turned to be unequal to separate the monophyletic irises groups. So, there is a need to define the morphological characters (e.g., bulb/rhizome structure, pollen type, petal reduction, seed coat structure, etc.) for *Iris* groups that could be the potential synapomorphies (the characteristics present in an ancestral species and shared exclusively, in more or less modified form, by its evolutionary descendants) for monophyletic lineages [17]. For the monophyletic *Hermodactyloides* section bulbous species such synapomorphies are likely the single-scaled bulb, terminal aril of a seed and simple crest of a sepal (a raised area along the sepal midvein).



**Figure 5a. Zangezur floral area landscapes – Lesser Caucasus; Armenia, May 2013. Kapan vicinities: Slopes of Khustup Mt., 1800 m, covered with fruiting *Galanthus lagodechianus* aspect under the hornbeam forest canopy.**



Figure 5b. Zangezur floral area landscapes – Lesser Caucasus; Armenia, May 2013. Kapan vicinities: *Anemonastrum fasciculatum* (L.) Holub at Khustup Mt. alpine meadow, 2000 m.

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Figure 5c. Zangezur floral area landscapes – Lesser Caucasus; Armenia, May 2013. Sisian vicinities: *Locus classicus* of *Iris sisianica* view with flowering *Amygdalus nana*; 1600 m.



Figure 5d. Zangezur floral area landscapes – Lesser Caucasus; Armenia, May 2013. Sisian vicinities: *Iris caucasica* in flower.

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