International Rock Gardener

ISSN 2053-7557

Number 76 The Scottish Rock Garden Club April 2016

---International Rock Gardener---

April 2016

This issue is again weighted towards bulbs and corms – if you'd rather see some more "traditional" rock garden or alpine plants, why not send in some photos from your own gardens or observations in the wild and share how you grow them or what the habitat conditions were in nature where you saw them? It does seem that "bulbs" (as, for an easy shorthand term, we call the whole range of geophytes with "lumpy underground storage organs") are as popular as ever on the benches of the UK plant shows. Pictures from the Spring shows displayed in the pages of the SRGC Forum illustrate the preponderance of bulbs at these events. As the season moves on the balance changes but the shows are always a delight to enjoy.

Cover picture: *Leucojum vernum* photo J.Ian Young

Leucojum: the gradually declining genus! by Wim Boens

This genus of bulbous plants within the family of the Amaryllidaceae, which once contained a great number of species, has been diminished to just two species. Originally the name *Leucoion* (from the Greek "Leukos" (white) and "Ion" (Violet or Viola, in this case it pertains to the scent) was used for all white "bells" known at the time, including *Galanthus* and *Acis*.

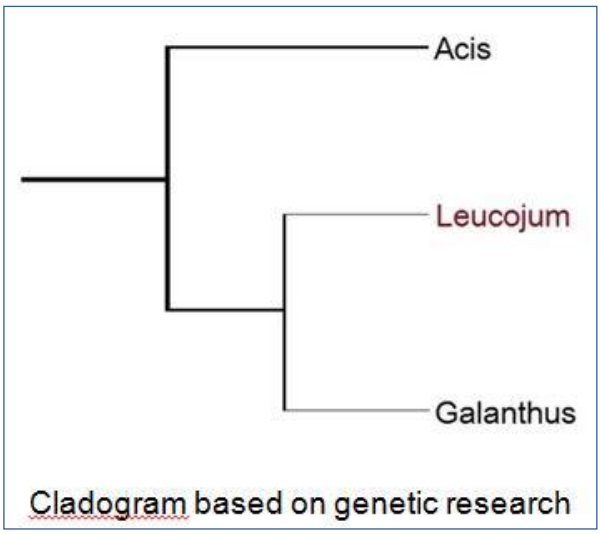
The first division was made in 1735 by Carl von Linné (Linnaeus). Based on the characteristic that the inner segments were shorter than the outer segments in the genus *Galanthus* and with *Leucojum* they had an equal length, he divided them up in both aforementioned genera.

In 2004 Dolores Lledo et al. published a study which showed that two species were genetically closer to *Galanthus* than the others and based on this data, they divided the genus even further with only 2 species remaining in the genus *Leucojum* and 9 species within the genus *Acis.* (This genus had been published in 1807 but had been re-included in *Leucojum* in 1878).

Visually *Acis* can be distinguished from *Leucojum*, because species in the genus *Acis* don't have a green apical mark on the outer segments. Also plants of the genus *Acis* grow mainly in drier places in south- west Europe and around the Mediterranean, while *Leucojum* species grow further north and love damper conditions.

Within the genus of the Snowflakes two species remain, namely *Leucojum vernum* and *Leucojum aestivum*. Both are sometimes called St. Agnes' flower, for the pure white flowers representing the chastity of the patron saint of virgins and gardeners. For the "Leucojocks" amongst us I'll have a closer look at these 2 species and their cultivars that are gradually appearing.

Left: Snowflakes in the Snow, photo Ingo Kaczmarek



Cladogram based on genetic research

Leucojum vernum (Spring Snowflake)

This species grows mostly in central-Europe and has the most northern range of distribution of both species. In the west of its range it grows from the east of France, to Germany (Eifel) and the Carpathian mountains in the east and to Poland in the north. This species has been naturalized as an escapee from gardens in many other European countries.

ISSN 2053-7557

This species is divided into two varieties, ***Leucojum vernum* var. *vernum*** is the most western growing form and has green apical marks. Sometimes forms with yellow(ish) apical marks can be found in this variety. ***Leucojum vernum* var. *carpathicum*** grows in the more eastern part of its range and has yellow apical marks. This transition happens gradually in the wild, with a lot of mixed populations and one can ask oneself if these forms deserve the status of a separate variety. There's also a different transition visible in the wild, with the most western forms being the smallest and those from the east of the range being a lot bigger. A third variety may be recognized; *L. vernum* var *vagneri,* here described as a group in the *L. vernum* complex. In the wild it does not grow mixed with the "regular" *L. vernum*, in the garden it does not cross with it and it is visibly distinct from the regular form by being more vigorous, sturdier and having paler green leaves.

Left: *Leucojum vernum* var. *vernum,* right*: L. vernum* var. *carpathicum* - photos J.Ian Young

In the meantime some cultivars have been selected from both varieties.

***Leucojum vernum* 'Butter-churn'** - photo John Grimshaw

Named for its butter yellow colour and somewhat "disturbed" look to its flowers. Also the river 'Churn' runs through Colesbourne Park, where it was found and named by John Grimshaw. Flowers can be single headed, with 8-10 segments; twin-headed with two perfect flowers, each with 8-10 segments; or fused at the ovary but showing two reproductive axes, each flower having about 8 segments, of varying size or shape. There's a clear variation in size and form. The biggest flower has grown to be 4.2 cm in diameter and the flower size is dependent on the vigour of the bulb. It looks less "shaggy" than 'Gertrude Wister', with smaller flowers but it is a better grower.

ISSN 2053-7557

***Leucojum vernum* 'Eva Habermeier'-** photo Wim Boens

Named by Thomas Seiler in honour of the German gardening-lady Eva Habermeier in whose garden he found this form. In her garden there were hundreds of regular *Leucojum vernum* var. *vernum* and just one clump with yellow apical marks, which also has the characteristic to make either two flowering stems per bulb or two flowers per flowering stem. It was this form which was named by Thomas.

***Leucojum vernum* 'Tentacular'**- photo Joe Sharman

Named by John Grimshaw. In this green, double form the flowers aren't fused as in 'Butter-churn' but the segments are all placed on one receptacle (as in a normal flower). The receptacle is usually expanded (and not circular) to make more place for the extra segments.

***Leucojum vernum* var. *carpathicum* 'Gertrude Wister'** – photo Jim Murrain

Named by Charles Cresson, for the owner of the garden in which it was found, the Wister garden near Swarthmore College in Pennsylvania (United States). This is a semi-double form with yellow apical marks and a green ovary.

ISSN 2053-7557

***Leucojum vernum* var. *carpathicum* 'Golden Bell'**- photo by Robert Johnigk.

This form selected by Robert Johnigk is a cultivar with a long yellow ovary and yellow apical marks. Often forms two flowers from each bulb.

***Leucojum vernum* var. *carpathicum* 'Podpolozje'** – photo J. Ian Young.

Brought into cultivation by Jānis Rukšāns, this was a wild selection found near the Polish village of Podpolozje in the eastern Carpathians. Superb large flowers with a larger apical mark than in the normal var. *carpathicum*. This one mostly carries two flowers on each stem.

***Leucojum vernum* var. *vernum* 'Green Lantern'**

Selection and photo made by Joe Sharman. The segments have a sharp apex and are up to 1/3 covered in green. When the flowers start to open, they take on the appearance of a Chinese lantern. Very vigorous form.

***Leucojum vernum* var. *vernum* 'Hoch die Tassen'** - photo Joe Sharman.

Named by Jan Pleuger,'Hoch die Tassen' means "Raise your glasses". The flowers of this cultivar always look up and do not hang down as in most other cultivars.

ISSN 2053-7557

***Leucojum vernum* var. *vernum* 'Milly'** –photo Joe Sharman.

Found by Joe Sharman and Harmen Kraai. This is a weird form with – in addition to the six normal segments – often one to six extra segments arising from the ovary. These extra segments are small and almost completely green. It comes true from seed.

***Leucojum vernum*, Vagneri Group** photo J. Ian Young.

***Leucojum vernum* var. *vernum* 'Null Punkte'** - photo Ingo Kaczmarek.

Cultivar name means "zero points". Found by Ingo Kaczmarek, this is perhaps the whitest form thus far. The apical mark is often reduced to two separate spots especially in juvenile bulbs. Mature bulbs frequently have all white flowers.

Found in the wild in Hungary (1886 Austro-Hungarian Empire, current Ukraine) where it was collected by the Hungarian botanist Vágner and originally described as *Leucojum vernum* var. *vagneri*. Earlier flowering, more robust with paler green leaves and generally sturdier than *L. vernum* var. *vernum*, it has two flowers on each flowering stem. All forms with green apical markings and two flowers on each flowering stem are now being sold incorrectly as *L. vernum* Vagneri Group. This is the counterpart, with green apical marks of *L. vernum* var. *carpathicum* 'Podpolozje', which has yellow apical marks. The plants from this group do not cross with regular *Leucojum vernum* var. *vernum* and always come true from seed. As stated before, this group probably deserves varietal status.

ISSN 2053-7557

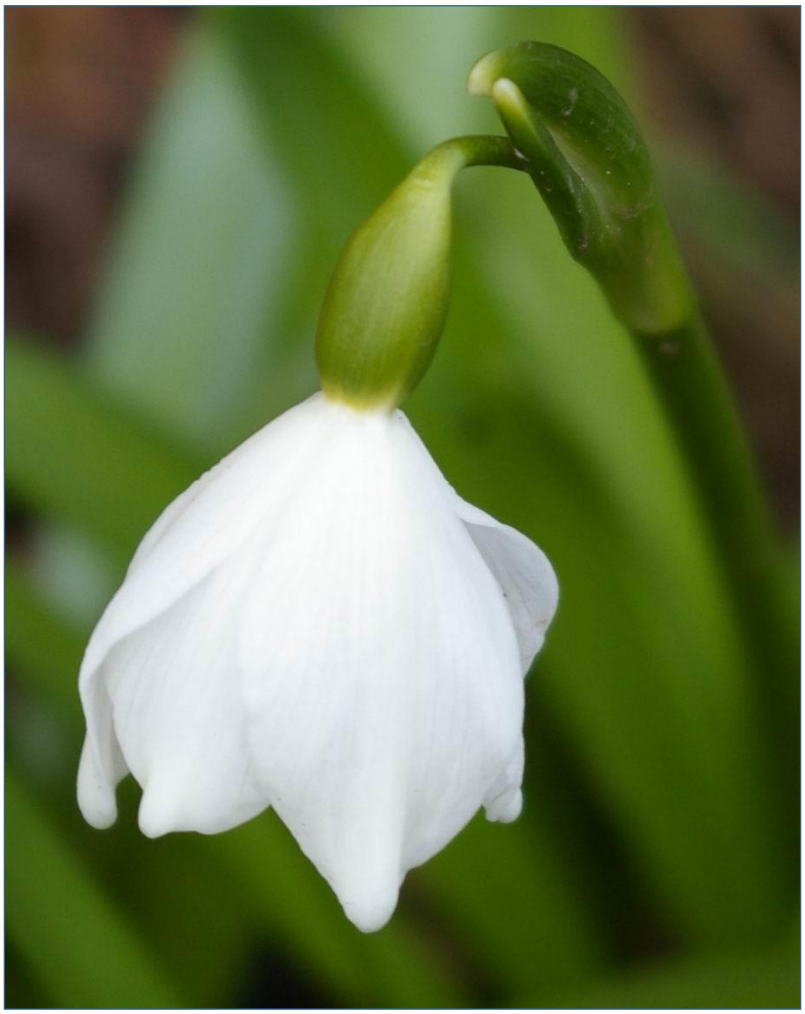
***Leucojum vernum* Vagneri Group 'Janus'** - photo Joe Sharman.

A very early flowering cultivar which always flowers in the first week of January. A selection with two flowers by Joe Sharman of *L. vernum*, Vagneri Group.
In the coming years a lot of new and exciting forms will be popping up.
Almost completely white forms, a form with a Galanthus-like flower, forms with yellow leaves, forms in which the colour of the apical mark bleeds far up into the segments, narrow-petaled forms..… ?

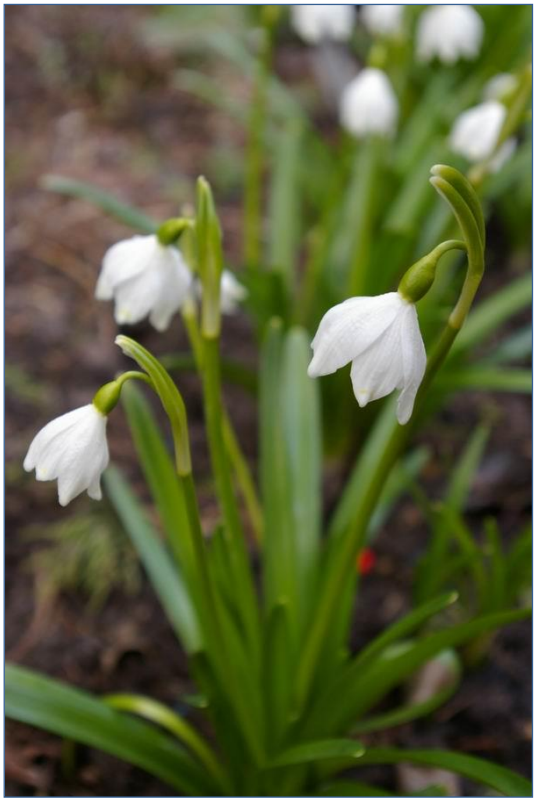
ISSN 2053-7557

***Leucojum vernum* var. *vagneri* 'Lothar'**

A German selection with very long pedicels and which can have up to three flowers on each bulb. This photo is by Jørn Jensen from the Den Alpine Have page.



This charmer was also found by Ingo Kaczmarek. Nearly pure white for the most part – it is known so far only as 'Kaum Zeichnung' (barely marked).



ISSN 2053-7557

Some un-named variations in ***Leucojum vernum***, first of all, some from Johan Mens –








ISSN 2053-7557

Another of Johan Mens' finds.

ISSN 2053-7557

Now for a selection of *Leucojum vernum* finds in the wild from Krzysztof Ciesielski:

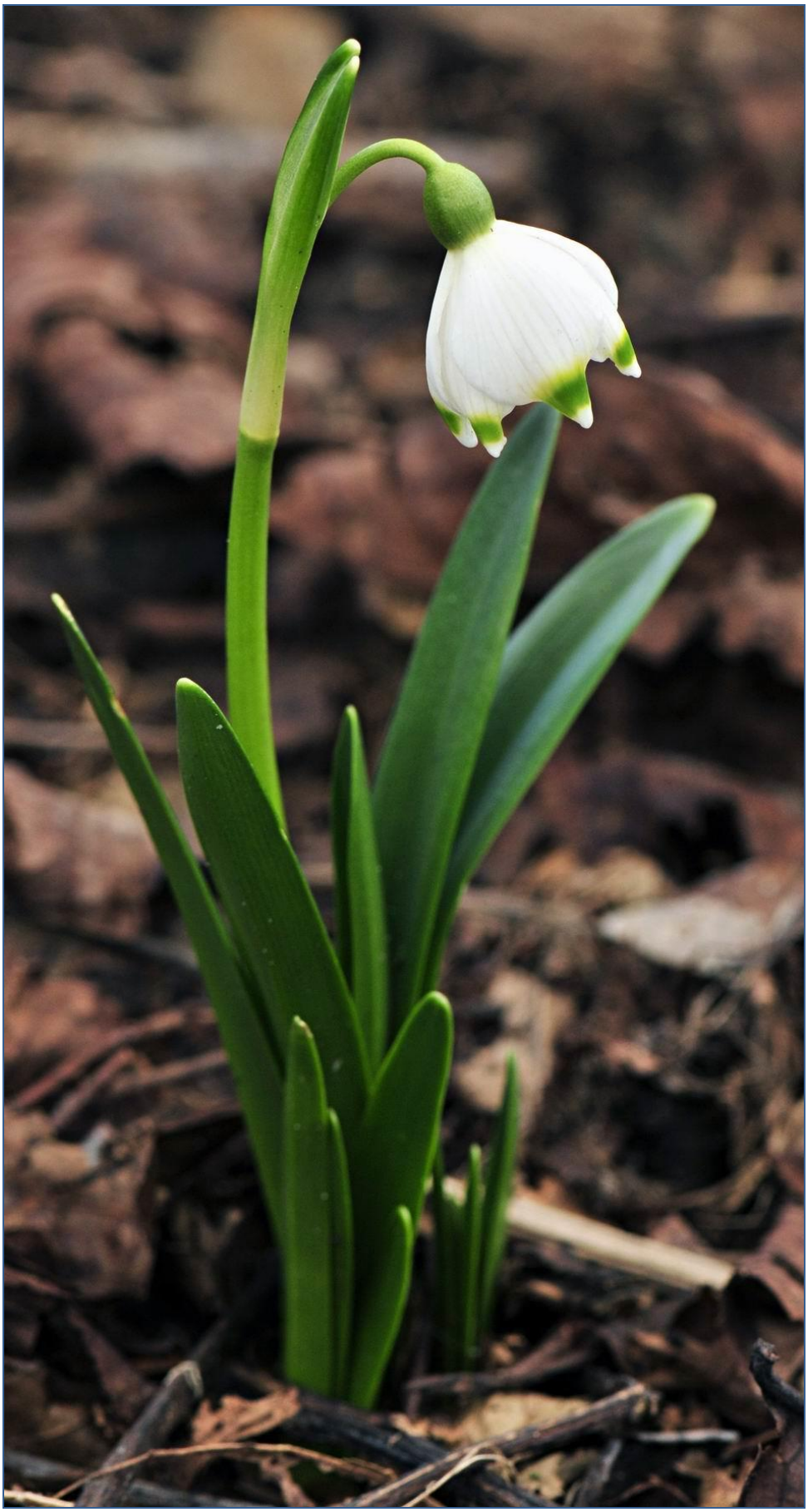







ISSN 2053-7557

This ***Leucojum vernum* var. *vernum*** from Stephen Has shows a quite distinct yellow zone around the green apical marks.



ISSN 2053-7557

Leucojum aestivum* subsp. *pulchellum - photo Jay Yourch.

***Leucojum aestivum* – the Summer Snowflake**

The Summer Snowflake grows from Northern Ireland in the west to beyond the Caucasus (Anatolia and Iran) in the east and from Greece in the south to the Netherlands in the north. In the wild they only grow in places which never dry out, in very localized places without direct contact between the locations. Naturalised in northern Europe, the Summer Snowflake flowers later than *Leucojum vernum*, starting in April-May, while the Spring Snowflake flowers at the same time as the snowdrops. Also, this species grows taller and almost always produces multiple (3-8) flowers on each flowering stem.
It has been divided into two subspecies. *Leucojum aestivum* subsp. *aestivum* is the most widespread while *Leucojum aestivum* subsp. *pulchellum* only grows in the swamps of the western Mediterranean. *L. aestivum* subsp. *pulchellum* is smaller, with greyer leaves which are held more upright. The bells of this subspecies are more open which gives them a starry appearance. Also, *L. aestivum* subsp. *pulchellum* has only 1 to 5 flowers on each flowering stem as opposed to 3 to 8 flowers for *L. aestivum* subsp. *aestivum*. The flowers of *L. aestivum* subsp. *pulchellum* are just 0.8-1.2 cm long, while those of *L. aestivum* subsp. *aestivum* have a length of 1.5-2 cm.

As far as I know there are only two named cultivars of this species:

***Leucojum aestivum* subsp. *aestivum* 'Gravetye Giant'** - photo Daniëlle Monbaliu.

This cultivar was named by William Robinson in 1924 and he named it for his estate in Sussex (Gravetye Manor). It's a more robust cultivar (grows to more than 70cm tall), with a copious amount of flowers (up to 7 flowers on each flowering stem) and smaller flowers. The flowers are borne above the leaves. Nowadays many wrongly named plants are sold as being this cultivar!

ISSN 2053-7557

***Leucojum aestivum* subsp. *aestivum* 'Nancy Lindsay'** - photo john Grimshaw.

This cultivar was named by Primrose Warburg as 'Nancy Lindsay's best', it originated in Nancy Lindsay's southern French garden "Serre de la Madone". With its height of 50-60cm, this cultivar is shorter than 'Gravetye Giant' and it has a more compact look to it. The flowers (5-6 on each flowering stem) are rounder and broader. The plant forms a compact clump more quickly than 'Gravetye Giant'.

In Culture -

Cultivation:

These species grow very well in western European gardens; both of them love the rain which is so very abundant in our countries. They're also quite frost hardy. *Leucojum vernum* grows well in the shade of deciduous trees, in a soil that doesn't dry out completely. *Leucojum aestivum* grows naturally in boggy areas and alongside rivers, so it is a superb plant for growing around ponds but they do well I drier places in the garden too. They grow best in neutral soil but they aren't too fussy about the pH. Keep in mind that var. *pulchellum* is less hardy than subsp. *aestivum*.

For best growing results they like some organic matter (compost, leafmould) incorporated in the soil and a bit of potassium-rich fertilizer while they're in growth. In short, they're easy and perfect for any garden!

Propagation from seed:

You can harvest the seeds from June on, even if the seed pods are still green. Around the middle of June, the seeds will be ripe anyway. After harvesting, it is best to sow the seeds as soon as possible. Or you can choose to sow them in autumn, after giving the seeds a good soak. They need at least one period of cold stratification to germinate, so make sure to leave the seed pots outdoors until you see the first leaves appearing in spring. From sowing until flowering it will take about 4-5 years.

The seeds of Leucojum have an elaiosome which indicates dispersal by myrmecochory. After removal of the elaiosome, ants often leave the seeds underground. So it seems logical to follow this natural way of sowing and to sow the seeds at depth (3-5cm deep) in a well-drained, neutral sowing-compost.

Vegetative propagation:

As with a lot of bulbous plants, Leucojum will increase naturally and can be divided but they are quite slow to propagate in this way. You'll have to wait for 5-7 years before you can divide a clump. Because

 ISSN 2053-7557

of this, a lot of people resort to chipping and twin-scaling which is possible with all bulbs from the family of the Amaryllidaceae. Since these techniques are well known and have been described in depth in Galanthus-literature, I will not elaborate on them here. I will say it is a slow process for Leucojum, taking 4-7 years to get the first flowers from the chips.

Pests & diseases:

As indicated above, two major problems can appear pertaining to the same phenomenon, namely drought. If you plant them in soil which dries out completely during summer, they will die a slow death and if you buy them in autumn as a dried out bulb, chances are high they won't show up in the following spring. If by miracle they do grow, it will take them a couple of years before they recover. It is best is to buy them freshly lifted, keep in some damp compost and plant them out immediately. Also, buying them in the green is a possibility. The fact is that the roots of these species never die off completely and if they do, for example by drought, they are almost certainly dead.

Otherwise, this is an easy genus; I personally have only encountered two problems, one being Narcissus bulb fly (*Merodon equestris* and *Merodon rufus*), known very well and feared equally well by galanthophiles. They can decimate a group of these plants in a single year. Luckily, most of the time they leave some small bulbs untouched or some new bulbs pop up from the remainder of the basal plate. The other problem I've encountered is snails and slugs; over here they never touch the leaves but they can eat a whole bunch of flowers in one night. And since I don't grow Leucojum to have a bunch of grassy (not very exciting) leaves in the garden, I find it important to keep the slimy critters away from my "white violets".

Stagonospora curtisii is a fungus which can be a problem too. Even though these larger bulbs can live for a couple of years with a staggie-infection, in the long run, when left untreated, they will succumb to it. Other fungal infections on Leucojum are known from a study in the wild where infections with 6 different fungal species were found. Also, two bacterial species (*Serratia plymuthica* and *Stenotrophomonas maltophilia*) are known to be able to cause bacterial bulb decay within species of this genus. Thus far I haven't seen any report of these fungal and bacterial infections appearing in plants in cultivation.

Conclusion –

Leucojum has benefitted from cross-contamination of the popularity of snowdrops. Because of this, more and more cultivars have been selected and still more will become available in coming years. Their growing popularity is rightly deserved, since these very garden-worthy plants deserve to be grown on a much wider scale. W.B.

Sources

Personal communication: Ruben Billiet, Dr. Krzysztof Ciesielski, Dr. John Grimshaw, Robert Johnigk, Axel Luther, Johan Mens, Daniëlle Monbaliu, Thomas Seiler, Joe Sharman, James Waddick, J. Ian and Margaret Young, Jay Yourch.

Bishop, M, Davis, A, & Grimshaw, J (2002). Snowdrops. A Monograph of Cultivated Galanthus. Maidenhead:Griffin Press.

Grimshaw, JM (2006). A flurry of snowflakes. *The Plantsman* Vol. 5 Part 1 March 2004 pag. 2–25

Grimshaw, J., Gatenby, E. & Sharman, J. (2007). Variation in Leucojum vernum. *The Plantsman* Vol. 6 Part 1 March 2007 pag. 38 – 43.

Grimshaw, J. (2008). Variation in Leucojum aestivum. *The Plantsman* Vol. 7 Part 1 March 2005 pag. 50-54.

Jandrasits, L. (2010). Fungal disease of protected plant species and of white mistletoe in the national park of Őrség. Keszthely: University of Pannonia.

Ruksans, J. (2007). Buried Treasures. Portland: Timber Press.

Stoyanova, M. *et al.* (2012). Bacterial bulb decay of summer snowflake/Leucojum aestivum L./ *Biotechnology & Biotechnological Equipment* Vol. 26 Part 6 November 2012 pag. 3338-3344.

Tait, B. (1990). Double snowflake found in USA. *The Garden* Vol. 115 page 437.

Ed.: Wim's article first appeared in the journal of the VRV – Vlaamse Rotsplanten Vereniging (Flemish Rock Garden Association).

ISSN 2053-7557

---International Rock Gardener---

SOME NEW CROCUS SPECIES : Jānis Rukšāns, Dr. biol.

International Rock Gardener - Online Journal. ISSN 2053-7557 April 2016 (pages 16 to 43)

Abstract: Six new species in the genus *Crocus* from the former USSR, Greece and Turkey are described.
Key words: *Crocus armeniensis, Crocus gembosii, Crocus georgii, Crocus puringiorum, Crocus sakaltutanensis, Crocus stevensii,* Armenia, Greece, Ukraine (Krim),Turkey.
Correspondence to: janis.bulb@hawk.lv

Retirement from the nursery chores has allowed me to devote all my attention to arranging my crocus collection, to checking the stocks and to try to identify the many still unnamed crocus samples. During 50 years dedicated to bulb growing, I succeeded in amassing around 1500 various crocus samples. Some of them are hybrids raised by me but such are very few; mainly, during the nearly 100 field trips, I focused on wild species. The first trip I made when I was 26 years of age, in 1972. In those early years, behind the “Iron Curtain”, it was only possible to travel within the former USSR where only a limited number of wild crocus species occurred. My first monograph on crocuses was published in 1982 (in Latvian) and mostly centred on cultivated wild forms and cultivars. 30,000 copies of the book were sold in the first year. With the falling apart of the Soviet Empire the rest of the world became accessible and I concentrated my interest on species, while all the cultivated forms (around 200) one by one disappeared.
Now, while inspecting the collection, I feel like a botanist from earlier times (and not only earlier) who sits in a herbarium and browses the sheets examining his own and other people gatherings, makes notes, and sometimes halts at seeing something unusual that requires deeper research, and this is the way that many species have been discovered and described. I would compare my present-day occupation with such a “browsing”, only instead of herbarium sheets I “browse” the pots with plants, which are still labelled only with sample numbers and were collected during the trips. Of course, on my bookshelf I do keep herbarium sheets, too, and many observations are made while examining dried flowers and pictures in my picture library. High-resolution photos allow the minutest of details to be enlarged on the computer screen. Besides, digital photography obviates the need to use a strong hand lens and a notebook in the field where the vagaries of the weather and other obstacles do not always facilitate such activities.

Crocus armeniensis in habitat

Nowadays much attention is directed towards crocuses and the advent of new names seems like an avalanche. Professor Arne Strid just recently, when I wrote him about the probability of having discovered new crocus species in Greece, replied: "*Thank you – I am glad you found the crocuses. However, the fact that two plants are different does not necessarily mean that they represent different species. Persons with curly hair and those with straight hair belong to the same species, and so do Europeans, Africans and Chinese. The species is a reasonably well-defined biological category within which there may be quite wide variation. In relatively well-studied groups such as Crocus there are scarcely any genuinely new species to be discovered in Europe – but many new varieties and local populations. Hyperinflation is just as unsound in taxonomy as it is in economy*." This remark just confirms my opinion that botanists, whether professional or amateur (like me), must very carefully examine their findings before coming forth with a new species. Umberto Eco in his famous novel 'Foucault's Pendulum' mentions "[..] Tetrapyloctomy [..] The art of splitting hairs four ways". I really hope that species published by me will never fall under this category…

There are different approaches as to how to treat would-be species. Helmut Kerndorff believes that only field observations on wild plants are acceptable and at least 30, in exceptional cases 20, plants of a species must be observed to be sure of getting any trustworthy data (private letter). Of course, such an approach helps to better understand the variation, but the variation can be much larger when more populations are observed. Actually more or less identical data can be acquired only by observing the same population in the same season and +/- at the same time. I have flowers of *Crocus gembosii* (described here) that I gathered for herbarium at the type locality at the start of the flowering season in 2007 and again in 2014 (at the end of blooming) and all have different plant part dimensions.

Crocus roseoviolaceus (left), ***C. rhodensis*** and ***C. reinhardii***

I discovered ***Crocus roseoviolaceus*** (following Dave Millward's advice; he showed its pictures on the Crocus forum of the Scottish Rock Garden Club) in a different location than H. Kerndorff and E. Pasche, who published it as a new species three months earlier than we had planned to do. Dimensions of the plant parts in my population (60-70 plants were observed) slightly differed from those observed by the authors (taxonomical identity of both were confirmed by DNA). H. Kerndorff and E. Pasche's data about ***C. rhodensis*** from the island of Rhodes (Greece) and about ***C. reinhardii*** from Iran were somewhat different from those I had, although they overlapped (private letter). The former species we observed in the wild, but at a different time, the latter I described from cultivated plants, but the German scientists observed from wild plants.

ISSN 2053-7557

Crocus laevigatus (on both sides) and diminutive ***Crocus pumilus*** (in centre).

Separation of the Cretan ***C. pumilus*** from ***C. laevigatus*** was possible only in cultivation, when both species grew in identical conditions. Brian Mathew in his monograph (1982) wrote about diminutive and odourless forms of *C. laevigatus* on Crete, stating that an “overlap in measurements is too great to be of value taxonomically”. Those observations were made on wild-growing specimens and on herbarium specimens of wild plants. Cultivation of plants in a more or less identical situation (i.e., in culture) allowed me to compare properly the measurements of various morphological features, for in the wild they are subject to the pressures of environmental conditions that vary from season to season and depend on the vagaries of the weather. These situations differ in each place and do not always allow the genetic potential to express itself fully.

Crocus archibaldiorum

The observation of cultivated plants highlights another problem, namely the possible cross-pollination between species that sometimes are geographically very distant. One such example is the crossbreeding between *Crocus gilanicus* and *C. autranii*, which in the wild are separated by around 1000km. I described ***Crocus archibaldiorum*** in its year of gathering, after it bloomed that same autumn, but the original stock died in the second winter and only open-pollinated seedlings survived. When a few years later I sent a leaf sample of these seedlings to the IPK Gatersleben for a DNA analysis, the results were bewildering – molecular investigation showed that the sample sent for analysis is a hybrid. The investigated gene region had one "*archibaldiorum*" copy, which differed from other "*speciosus*" crocuses, and one copy was identical to the geographically very distant (separated by almost 2000km) *C. pulchellus*. So both species had hybridized in the first season with me which explained why among the seedlings I had observed atypical plants; I had even started to doubt my original diagnosis (description). Fortunately, pure *C. archibaldiorum* stock was re-collected very recently at its type locality. The geographical separation had ruled out the necessity for any genetic barriers guarding against crossbreeding. I pollinated *C. adamii* from Georgia with another, still-undescribed species from the “*biflorus*” group from Bulgaria and was surprised when I gained a good batch of seeds. The seedlings have already bloomed and, as it is usual in F1 hybrids, they all look identical.

ISSN 2053-7557

Sometimes it is very difficult to find the right **morphological** features to separate two different species. ***Crocus concinnus*** and ***C. mawii*** are close neighbours in the wild and were described by H. Kerndorff and E. Pasche from the opposite sides of the same mountain ridge.

Crocus concinnus

Crocus mawii

***Crocus concinnus* on Aldürbe Yaila**

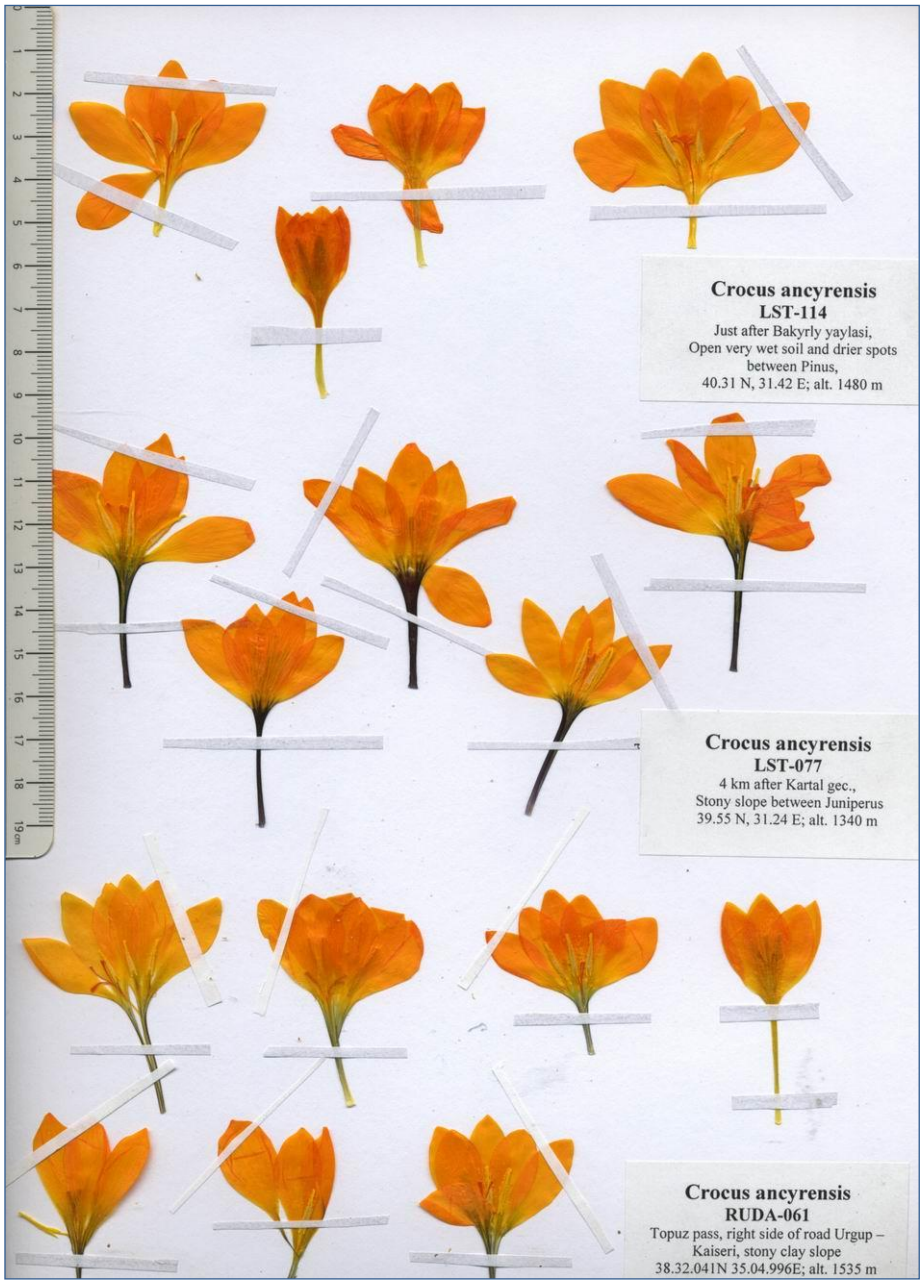
According to the original descriptions, both can actually be separated only by the filaments, which in *C. concinnus* are densely papillose while those of *C. mawii* are glabrous. Other features more or less overlap. Plants from the Irmasan mountain pass (*C. concinnus*) invariably have papillose filaments, whereas those from a neighbouring population on the Aldürbe Yaila may not. Both are good species and their distinctiveness is confirmed on DNA level, but identification without the knowledge of the exact location from where the sample has come is fairly difficult.

***Crocus tauricus* -** Ai-Petri Yaila - bract and bracteole

For correct naming, alas, it is sometimes absolutely necessary to know the origin of the stock. H. Kerndorff & al. (2014) in their key for crocus species from series *Isauri* for ***C. tauricus*** include a thesis “bracteole occasionally present, crocus of the Crimean peninsula”. The first part (“bracteole occasionally present”) seems to be incorrect as in all the plants observed by me (~70) the bracteole was present, albeit very variable in size from almost equal to the bract to very narrow, ligulate, and occasionally so tightly adpressed to the inner surface of the bract that could be easily overlooked. Thus for identification purposes there remains only the origin of the plant – “crocus of the Crimean peninsula”. Sadly, for most species described by both German scientists the exact type locality is not known and usually far too inexact coordinates are given that are of no help in the identification of plants. Series *Verni* houses two pairs whose separation without the knowledge of the geographical origin is very difficult: one is *C. siculus* from Sicily and *C. vernus* (former *C. albiflorus*) from Helvetia, the other – *C. neapolitanus* and *C. neglectus* (Harpke et al., 2015).

ISSN 2053-7557

I doubt that geographic distribution needs to be the most necessary feature in the distinguishing of species therefore I always try to find morphological features to facilitate the separation of a new species from its look-alikes. However, because of the very great intra-specific variation within the genus *Crocus* that is not always possible. There are several cases when distinguishing without the knowledge of the stock's origin is quite difficult as the features overlap too much and much depends on the interpretation of them. Such are complexes formed by *Crocus speciosus* and *C. chrysanthus* – in both under one name are comprised many genetically different species. Some of them are now published, but many still await their turn. Quite recently it was found that under the name of ***Crocus ancyrensis*** hide at least 4-5 different species (Harpke et al., 2014). When I put on a map the locations of my gatherings of this species, it turned out that all the different cytotypes were well separated geographically. By overall appearance the flowers seem very similar, the sole difference being the colour of the flower tube in some stocks. As I never gave much attention to this species, my gatherings were very fragmented and lacked field studies on the variability and distribution, so that is something for future researchers.



Crocus ancyrensis

As I mentioned earlier, one of the groups of species that comprises plants of different genetic makeup, which at the same time in general appearance are more similar than not, is *Crocus speciosus*. These are species whose leaves develop after flowering, thus observation of the same plants in flower and in leaves in the field is practically impossible, for the same locality (sometimes very remote) must be visited twice, and all these endeavours hinge very much on the whims of weather and anthropogenic factors, e.g., grazing by cattle. So more or less reliable data are likely to be acquired only on cultivated specimens. The key for species of this group that I published in 2013 lacks leaf characteristics, as was correctly noted by Kerndorff & al. (2013A), when they published *C. striatulus* from the same group. The reason was that the data were gathered from the wild plants at their type locality at blooming time. Different interpretation of features had caused disparities in the description of my *C. elegans* (as subsp. *elegans* – 2013) and *C. brachyfilus* of I. Schneider (2014) which genetically turned out to be the same species and according to the rules of the Code the accepted name is that of Schneider. The research on this group is not yet finished and as it was noted by Kerndorff & al. (2013A): "the revision of *Crocus speciosus* in Turkey and Iran is not complete".

ISSN 2053-7557

I published *C. archibaldiorum* from Iran, near the S.W. edge of the Caspian Sea, but the plants from near the S.E. edge of the Caspian Sea are very different both ecologically and morphologically. Several unpublished taxa from this complex grow in these two countries. Here I describe two new "*speciosus*" species from the former USSR.

All the species within the "*Crocus speciosus*" complex ecologically can be divided into two groups – the forest type and the open meadow type. For some species it is not easy to define their ecological preferences. *C. bolensis* at the type locality grows under sparse pines and in somewhat protected areas, even in deep shade under hazelnuts, but on the Kuyucak Yaila on the Çilek Geç it grows on open meadows. The crocus growing in the Crimean peninsula in Ukraine (currently occupied by Russia) undoubtedly is a typical forest type species. Although occasional plants were found on the Chatyr-Dag (Tschatir-Dag) Yaila, too, they were always found near groups of trees, where they were provided some shade during the midday. The most flourishing populations, though, were found in a forest, under sparse big trees, in lighter situations. The habitat of this crocus on the Ai-Petri Yaila is very similar. With the help of my Ukrainian friends (Dima Zubov and others - their names I'm not mentioning for their safety reasons, as they still are living in territories occupied by Russia) I was able to explore the wild populations during several trips to Crimea, shortly before the Russian invasion.

Crocus puringiorum in the Crimea

Actually I am somewhat surprised that this crocus was not described earlier because details of its genetic dissimilarity to all other species in this group were known long ago. C. Brighton et al. had already in 1983 published their study on cytology of *C. speciosus* s.l. and found that the Crimean population had 2n=18 and that the chromosomes were also morphologically very distinct. This fact alone allows one to regard the Crimean crocus as a separate species. Only one other, geographically very distant gathering from S Turkey (Konya Province, S of Beyşehir – probably *C. brachyfilus*), has the same chromosome number although morphologically it is different. All other species in the

 ISSN 2053-7557

speciosus group have 2n ranging from 6 to14. I decided to name the Crimean crocus after the Latvian botanist Nikolay Puring (Puriņš) (1845-1904) who in 1900 worked in Crimea and described *C. tauricus* as differing from other *C. biflorus* group species.

Crocus puringiorum – in habitat, left and cultivation, right

Crocus puringiorum Rukšāns **species nova**. Type: Ukraine, Crimean Peninsula, in deciduous forests below Chatyr-Dag Yaila, near Perevalnoye (Perevalne) 44°48 ' 55.21 N 34°20 ' 09.48 E, alt. 505m, lighter spots under large trees: 13-10-2013. *Rukšāns & Zubov*, 13CRA-64. Holotype GAT.

Habitat and distribution – in slightly lighter spots in deciduous forests or in grass, at the edges of small groups of trees or shrubs, on yailas in Crimea (Ukraine) at altitudes of 500-1100m.
Flowering time – generally one of the earliest blooming species within the *Crocus speciosus* aggregate, in cultivation the flowering starts in September-October, just after *C. ilgazensis*, but I have had a sample blooming in the first days of August (from the Ai-Petri Yaila). In the wild the blooming period is the same.
Corm – depressed globose, 13-18mm in diameter.
Tunics – thin, membranous, with uneven basal edges and occasional, irregular splits.
Tunic neck – mostly very small, formed by untidy, irregular, narrowly based triangular splits of the main tunic, but occasionally much larger, consisting of longer splits of the main tunic and persistent old cataphylls from the previous season.
Basal rings – present, thin, membranous and brittle, wide, with +/- smooth slightly waved upper edges or the upper edge is very irregularly pronged, with occasional splits, giving untidy impression.
Cataphylls – 3, whitish, at the top brownish shaded, turning brown in spring.
Prophyll – absent.
Leaves – 3(-4), dark green with some greyish suffusion, sparsely papillose on lamina and edges, 3-4mm wide, lateral channels widely open and without ribs, almost flat, white stripe between 1/4 to 1/3 of leaf width, emerge only in spring.
Perianth tube – white to greenish throughout, or in the upper part striped, though more often suffused purplish or greyish.
Bract and bracteole – membranous, white, bracteole smaller.
Throat – white, nude.
Filaments – (8-)10-12(-14)mm long (on average 11mm, n=26), nude or papillose, white.
Anthers – (9-)11-14(-20)mm long (on average 12-13mm, n=26), yellow.
Connective – mostly white to whitish, rarely yellow.
Style – split slightly below the tips of the anthers into 3-5mm long yellow to orange branches, slightly higher subdivided into more or less numerous secondary branches, further fringed or minutely divided at the apex, usually slightly overtopping the anthers, on average for some 7-8mm (n=27), rarely ends

ISSN 2053-7557

at the tips or below the anthers (11%).
Flower segments – obovate to oblanceolate with subacute to pointed tips, sometimes somewhat mucronate, lighter to darker blue, occasionally purplish, albinos extremely rare (only 1 such seen), usually the inside more or less intensely feathered or veined, the inside of the inner segments lighter, with more prominent veins, rarely the veining inconspicuous.
Outer segments – (45-)55-56(-65)mm long and (9-)15-16(-21)mm wide (n=17), outside pale lilac, sometimes tinted greyish white, darker at the tips, with parallel slightly darker veining, rarely suffused, at the base whitish, inside similar, only darker at the tips.
Inner segments – 43-**53-**60mm long and 10-**14-**20mm wide (n=17), if outer segments with a darker tinged outside, then that of the inner segments slightly lighter but with more prominent veining, if the exterior of the outer segments whitish, then that of the inner segments darker lilac.
Capsule – up to 20mm long and 8mm wide, dark buff to light brownish, carried well above ground at maturity.
Seeds – subglobose to slightly elongate, around 2.5 to 3mm long/in diameter, very dark reddish brown, with a small almost blackish caruncle and a poorly developed raphe.
2n = 18.

Crocus puringiorum corms from Crimea and ***Crocus puringiorum albus*** from Chatyr-Dag (Tschatir-Dag).

Below: Dima Zubov with Jānis Rukšāns

ISSN 2053-7557

Crocus puringiorum (previously planned to be named as puringhiorum) Crimea, Tschatir-Dag Yaila (Chatyr-Dag Yaila)

ISSN 2053-7557

Several years ago Armenian bulb enthusiast Zhirair Basmajyan sent me some corms of a crocus he had identified as *Crocus speciosus*. The huge size and the colouring of its flowers so intrigued me that I immediately arranged a trip to Armenia for the following autumn. With the kind help of Zhirair we visited several locations where crocuses of the *C. speciosus* s.l. group grew. It turned out that two ecologically very distinct species occur in Armenia. One is a typical forest type "*speciosus*", practically identical to the type species observed by me in Georgia near Tbilisi and at Gremi, and growing only in the shade of the trees, in a very similar habitat to that of *C. puringiorum* – with only a few plants entering the adjoining meadows but still keeping themselves near the forest edges. In Armenia we observed them in large numbers near Ijevan (Makaravank Monastery) and Geghard (both in the deep shade of a gorge under shrubs near the monastery and in shrubs on a higher yaila).
The other populations observed were found in completely different ecological conditions. Those we came across from Goris to Nagorno-Karabakh, and most likely they also occur in that internationally unrecognised republic which we did not visit. This crocus turned out to be very different and thus worthy of a name of its own, so I decided to name it after its homeland as *Crocus armeniensis*.

***Crocus armeniensis* 'Goris'**

C. armeniensis corm and opening bud

Crocus armeniensis Rukšāns **species nova**. Type: Armenia, an open field near Goris, 39° 31' 02.65 N 46° 22' 07.04 E, alt. 1660 m: 19-10-2013. *Rukšāns & Basmajyan*, 13ARM-67. Holotype: GAT.

Habitat and distribution – a typical open field plant growing on meadows and cultivated fields, never found in shrubs (not even near the edges of the fields), at altitudes from 1500 to 1800m. Observed in a quite large area from Goris to Nagorno-Karabakh, but could be distributed much wider.
Flowering time – in the wild – October-November, in cultivation – around the end of September.
Corm – subglobose to depressed globose, up to 20mm in diameter.
Tunics – harder than papery but not coriaceous, split at the base upwards into wide (5mm and more) segments with many merely 1mm long and around 0.5mm wide subsplits.
Tunic neck – formed by up to 10mm long broad-based triangles, subdivided at the top into 5mm long secondary, narrow, sharp subsplits.
Basal rings – wide, very thin, with uneven edges, with no teeth.
Cataphylls – 3, membranous, white, in spring turning greyish brown.

ISSN 2053-7557

Prophyll – absent.
Leaves – 3-5, soft green (distinctly greener than in other species of the "*speciosus*" group), with papillose keel and margins, 5-8mm wide, lateral channels without ridges, wide with downwards and very slightly inwards curving edges, the white stripe narrow – 1/5 to 1/4 of the leaf width; appear only in spring.
Perianth tube – whitish or greyish yellow, more or less heavily spotted brown, more at the top, sometimes with brown stripes.
Bract and bracteole – white, sometimes brownish at the top, only emerging slightly from the ground, bracteole much smaller, usually hidden by the bract.
Throat – light yellowish to light yellow, glabrous or with a few minute hairs.
Filaments – 10-**12**-15mm long (n=15), papillose, rarely minutely pubescent, whitish to light yellow.
Anthers – 15-**20**-28 mm long, yellow, occasionally creamy (?), usually almost twice as long as the filaments, with long (~3mm) pointed basal lobes, tips flattened, usually with a distinct notch at the top, less often subacute.
Connective – paler yellow.
Style – orange-yellow to orange-red, deeply and multi-branched, branches (4-)6(-10)mm long (n=15), subdivided into curved sub-branches of the same length or slightly shorter, and distinctly wider and fringed at the apex, always and mostly prominently surpassing the tips of the anthers.
Flower segments – inside lighter or darker light violet with very conspicuous dark stripes, on the outer segments more confluent and less expressed, giving an impression of a darker shade.
Outer segments – 51-**62**-72mm long and 15-**20**-26mm wide (n=18), outside prominently striped on lighter or darker lilac-violet ground, stripes somewhat diffused at the edges, rarely stripes slightly confluent or segment outsides speckled (observed in a very few individuals).
Inner segments – 49-**57**-64mm long and 16-**21**-26mm wide (n=18), outside in general darker than that of the outer segments and close in colour to the inside without the prominent darker stripes.
Capsule and **seeds** – not observed.
2n = ?

Crocus polyanthus

C. polyanthus habitat: photo by Dima Zubov

In flower colour *Crocus armeniensis* remotely resembles *C. archibaldiorum*, but the stigma is always positioned much higher – consistently overtopping the anthers and in most cases very significantly. Recently I got a few corms collected close to the *locus classicus* of ***C. polyanthus*** Grossheim (*nomen nudum*) in the Talysh Mountains, S Azerbaijan. The location is midway between those of *C. archibaldiorum* and *C. armeniensis*. The species grows on open fields and judging by the pictures it somewhat resembles *C. armeniensis* but without more detailed observations it is not possible to determine its status. Zhirair Basmajyan got hold of two corms of a similar crocus reported as coming from the surroundings of Vahagni.

ISSN 2053-7557

***Crocus armeniensis* aff. Vahagni**

Zhirair's crocus arrived together in soil brought from "somewhere in the vicinity" to raise the garden level. Both plants looked quite similar to those from Goris. The throat is deep yellow and anthers in both specimens are creamy, lighter than is usual in *C. armeniensis.* The exterior of the outer segments is pale and monochrome; that of the inner segments – striped. These observations have been made only on two individuals, but their general similarity to the typical *C. armeniensis* boosts the enthusiasm to find this population in the wild and make more detailed observations on their variability and ecology.

We found *Crocus armeniensis* exclusively on open fields and cultivated land. In the nearby shrubs there were at most a couple of individuals and then only on the border between the two habitats. *C. armeniensis* is perfectly adapted to cultivated fields. It grows on freshly ploughed or abandoned stretches of land, and I have rarely seen such crowded populations where in close proximity grow and bloom millions of plants. The corms are situated very deep in the soil, thus they suffer little damage from ploughing, but even if they happen to be turned up they still grow and bloom well.

Flowers of ***Crocus armeniensis*** are among the largest in this group. The same was observed in cultivation and in size they are very close to the old Dutch cultivars. Most distinct is the many-branched stigma, which seems to be the most branched within the entire complex, and as a rule it significantly overtops the anthers. Zhirair Basmajyan has selected a nice form of *C. armeniensis* which he named after the locality where it was found as 'Goris'. This cultivar increases well by cormlets formed at the corm base, but I have observed cormlet-producing specimens only sporadically in the wild. *Crocus armeniensis* is a good grower in the garden as well as in pots under cover. It sets seed well, but because of the good vegetative rate of increase I have not collected them yet. This explains why in the description there is no information on the characteristics of the capsule and seeds.

Another group where more thorough research has just started is *Crocus chrysanthus* s.l.. Distributed within a large area it belongs to the species where it is highly problematic to define the type gathering. I have tried to "cast some light" on this subject but I was wrong in lumping the plants from Mt. Falakro in Greek Macedonia with those from Galičica (the Republic of Macedonia). Although superficially they

ISSN 2053-7557

are fairly similar, there are several morphological features that are dissimilar, so only the plants from Galičica should be regarded as belonging to the type *C. chrysanthus* (in accordance with Mathew's definition in 1982 – from *Ancient Roumelia*). Of course, both above-mentioned gatherings differ greatly from the plants occurring in Turkey where undoubtedly the majority of taxa from this group are distributed. This does not mean however that European populations constitute one species. Initial observations on populations from the Vertiskos Ridge, Mt. Parnassus (both in Greece) and some others show a great variability in morphology. Whether they are really different or represent the same species can be verified only with the help of more comprehensive field researches and DNA checks.

In 2014 I published the descriptions of three new species (*CC. henrikii, muglaensis, uschakensis*) from the *Crocus chrysanthus* complex. One more species was not described for the lack of a good herbarium and, as in the spring of the same year I had planned a trip to Turkey, its publishing was left for later. Now I am filling this gap by describing it here as ***Crocus gembosii***. It by no means is the last species from this complex occurring in Turkey. In my collection grow many samples from distant and fairly differently looking populations of *C. chrysanthus* s.l.
from Turkey, but to make any decisions about their taxonomical status much more detailed field observations and researches on DNA level are needed.

Crocus chrysanthus* 14TUS-029 now renamed as *Crocus gembosii Rukšāns ***species nova.***

ISSN 2053-7557

***Crocus gembosii* Rukšāns *species nova*.** Type: Turkey, Antalya Province, Gembos Yaila, 37 °15.855 N, 31 °27.646 E, alt. 1220m: 24-03-2014. *Rukšāns,* 14TUS-029. Holo: GAT.
Habitat and distribution – known only from the type locality where it grows on the yaila at altitudes of 1200-1300 m on a wet meadow together with the blue-flowered *C. mawii* and other bulbous plants (*Eranthis, Scilla, Corydalis, Galanthus*, etc.) and blooms near melting snow.
Flowering time – March.
Corm – globose, 9-12mm in diameter.
Tunics – papery, split at the base into 1-1.5mm wide segments with occasional short subsplits.
Tunic neck – up to 5mm long, bristly, formed by narrow pointed splits of the main tunic, occasionally the splits at the base wider, somewhat triangular but shortly narrowing at the top.
Basal rings – up to 4, strong, not coriaceous, 1mm wide, upper edges mostly saw-like, with 0.25mm long teeth, occasionally some teeth are with prolonged tips up to 1mm long. In a few plants basal rings with toothed edges were observed: teeth around 1mm long, each longer one interspersed with a very short one.
Cataphylls – 3, white, with age turn yellowish(?).
Prophyll – absent.
Leaves – (4)5-6(-8), one individual in 50 observed had 10 leaves, dark green, glabrous to scabrid (rarely), lateral channels with (1)2 ribs, the white stripe 1/3 or somewhat less of the leaf width; mostly below or sometimes overtopping the flowers, especially at the end of anthesis.
Bract and bracteole – membranous, silvery, well exserted from the cataphylls, bracteole distinctly narrower, shorter or somewhat longer than the bract.
Perianth tube – mostly yellow with brown stripes, occasionally plain yellowish, brownish or purplish.
Throat – glabrous, of the same colour as or darker yellow than the segments, occasionally orange shaded.
Filaments – 6-**7-**9mm long (n=27), glabrous, yellow to orange-yellow.
Anthers – 10-**12-**14mm long (n=27), yellow, arrow-shaped, gradually narrowing to a pointed tip, with 2 mm long pointed basal lobes, occasionally parallel-edged, with rounded tips.
Connective – very variable, mostly yellow, sometimes whitish or more or less blackish or greyish throughout or only at the tips.
Style – split into three short, dark orange to red branches, ending below the tips of the anthers or rarely reaching them; in one of 25 observed overtopped the anthers.
Flower segments – colouring very variable, mostly more or less bright yellow; inside colour the same in both whorls without any markings.
Outer segments – 29-**34**-37mm long and 8-**11-**15mm wide (n=38), outside colouring extremely variable – from plain lighter or darker yellow with no markings at the base, with a small greyish or brownish suffused basal blotch, or more or less striped to feathered deep brown; the length of stripes vary – from short to as long as the segments.
Inner segments – (24-)31-32(-36)mm long and 8-**11-**13mm wide (on average 0.5mm narrower than the outer segments, n=38), outside of the same yellow colour as the outer segments or slightly darker, the basal blotch, if present, smaller than on the outer segments, without stripes.
Capsule and **seeds** – not observed.
2n = ?
Etymology – named after the Gembos Yaila where it was discovered.



Crocus gembosii - JJVV-043-63; JATU-068-01; R2CV-054-02

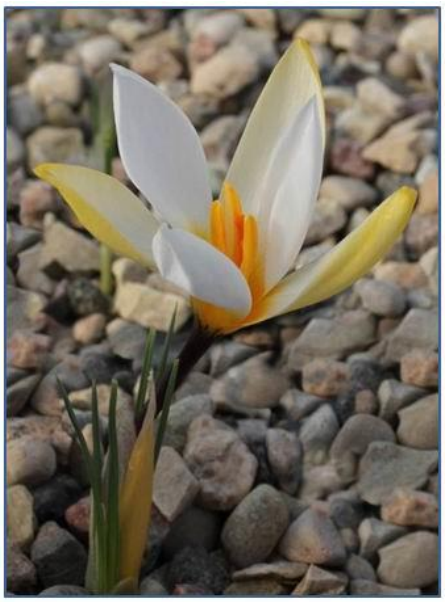
ISSN 2053-7557

Crocus gembosii JATU-068-05 in habitat

Since the very first visit to the Gembos Yaila in 2007, when Colin Mason showed me this beautiful place not far from Akseki, I had a feeling that the yellow crocus growing there and regarded as *Crocus chrysanthus* was something different, but it was after several visits there and the observation of a large number of plants that it became clear that it really was a different species.

***C. gembosii* JJVV-042-76**

Pale ***C. gembosii***



***C. gembosii* JJVV-045-01**

The population of the yellow "*chrysanthus*" crocus on the Gembos Yaila named here as *Crocus gembosii* is the most unique among all the populations of the *C. chrysanthus* aggregate seen by me. Although I observed co-habitation of blue-flowered species from the "*biflorus*" group and the yellow-blooming *C. chrysanthus* sensu lato in several places, only on the Gembos Yaila it seemed that the blue and yellow species (*C. mawii* and *C. gembosii*) readily and frequently cross-fertilized and their offspring were fertile. Occasional hybrids can rarely be found almost everywhere where both species

ISSN 2053-7557

sensu lato meet but as a rule they are sterile. Only in spring of 2014 I finally revisited the place because I needed to prepare herbariums and make detailed observations and take measurements of the plants in situ. That spring was very early and our team arrived at the Gembos a bit too late when the crocuses had almost finished blooming but we found a few spots where more snow had accumulated during the winter and it had melted just prior our arrival, so we still saw several hundreds of flowering plants there. The observed micro-populations were more uniform than usually seen and among them the number of individuals with the black colour in the anthers was significantly smaller than was seen at the peak of blooming, so I didn't estimate the percentage of such plants in the populations, because it might have been misleading. Only very few of the usually later-blooming *C. mawii* were seen.

Top row from left: 1) *C. mawii* & C. *gembosii* 2) *C. gembosii* hybrid or *C. mawii* 3) *C. gembosii* with black stigma 4) *C. gembosii* hybrid R2CV-059.
Lower row from left: 5) *C. gembosii* hybrid JJVV-043 6) *C.* g*embosii* F2 hybrid
7) *C. gembosii* JATU-069 8) 'Sunspot' x *C. gembosii* seedlings.

Every time I visited this area I found an endless variation in flower colouring. The flanks of the Gembos Yaila are quite steep and end at the foot of a steep rocky slope with coniferous forest. Usually the yellow forms of *Crocus gembosii* typically bloom higher up along the slope, then a little lower follows a zone where both colours (yellow and blue) mingle and it is here where many individuals look like hybrids between both species. Just there were seen the majority of the individuals with striped flowers, with the black colour in the anthers and even a few with black stigmas. Still lower down the overall colour gradually shifts into a band created by the blue-flowered *C. mawii.* Sometimes it is very difficult to tell what it is in front of you – a different colour form or a hybrid? In some individuals amazing combinations of colours were observed – yellow with blue or brown, sometimes a deep purple flower tube was topped with light yellow outer segments and snow white inner ones, etc. The outward aspects do not permit to draw a conclusion whether the plants with the extreme aberrations in the morphological features belong to *C. gembosii* or they are the result of hybrid vigour and are actually

 ISSN 2053-7557

the offspring of both species. *Crocus mawii* occasionally has black connectives – maybe the yellow-flowered plants with black connectives are hybrids? I inter-crossed several individuals which looked like hybrids and among the seedlings appeared plants with clear blue flowers, indistinguishable from the true *C. mawii*, the yellow ones looked like "*C. chrysanthus*", and the rest resembled hybrids in which the features of both species, especially the colour, had blended. Just this capacity to hybridise confirms even without chromosome and DNA analyses that there grow different yellow-flowered species, earlier regarded as *C. chrysanthus*.

Crocus gembosii prefers moister growing conditions than its blue-flowered neighbour *C. mawii*. It always blooms near melting snow where the soil is really damp. *C. mawii* follows, but only when the soil becomes drier. It is possible that in those micro-depressions observed in 2014 the conditions were too wet for *C. mawii* and the potential hybrids between the two species, and this can explain the smaller percentage of individuals with the black in the anthers. Of course, only the analysis and comparison of DNA of all flower types there can help to solve this riddle, but that was not the case for me in this research.

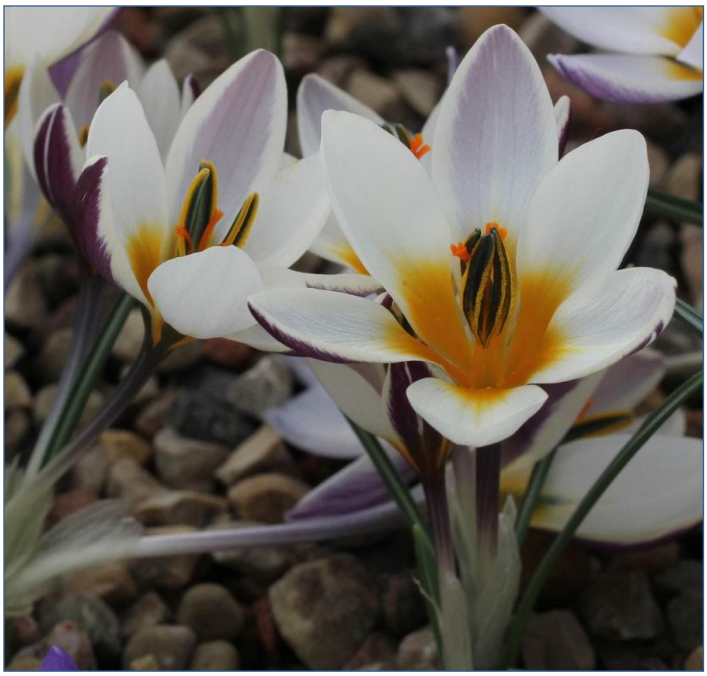
The famous cultivar distributed by Pottertons Nursery (UK) as *Crocus chrysanthus* 'Sunspot' with prominent black stigmas was collected originally just on the Gembos Yaila (R. Potterton, personal information). That is confirmed by the fertility check which found that it was almost self-sterile (although some seeds from self-pollination were observed). 'Sunspot' hybridises well with *C. gembosii* and sets seed abundantly. I crossed 'Sunspot' with black-anthered forms of *C. gembosii* in the hope to get a flower in which the black anthers are combined with a black stigma. Some hybrids had both the desired features, though the flower shape could have been much better, so the project is still on-going and I am repeating crosses with other forms and back to 'Sunspot'. Attempts to cross 'Sunspot' with the black-anthered *C. muglaensis* would not succeed. There are other places near Akseki where a blue crocus (*C. concinnus*) meets another yellow member from the *C. chrysanthus* clan, but no traces of hybridization have been detected.

In my notes I characterised the Gembos Yaila as a natural breeding station with many potential cultivars-to-be. Unfortunately now this location is under threat of destruction. During our last visit there the slopes were divided into lots for new houses and small gardens. *Crocus gembosii* is a very easy plant; though all the individuals collected there grow in pots under cover they should be able to grow outside as well. They set seed easily and multiply by splitting, although not so readily as the cultivars of the so-called "*C. chrysanthus*" group. In summer the pots can be brought outside, as they do not need very hot summer conditions, but this species does not suffer if it stays in the greenhouse during dormancy.

For a long time all the samples that I had acquired as "*Crocus crewei*" in fact represented the Greek *C. melantherus*. Then I asked Jim Archibald about the locations where he had seen *C. crewei*. Shortly before Jim passed away, in 2010 he sent me a letter about *C. crewei*: "I first went there with Norman Stevens and we travelled up from Honaz Village to the upper pastures facing out westwards towards Pamukkale. We met shepherds there at a camp, parked the car close by and walked up to the ascent ridge to the east of the main Summit. Below the ridgeline there were earthy patches interspersed with quite mobile rocky screes. *Fritillaria carica* and *Corydalis wendelboi* grew there, the latter around thorn bushes with *Anemone blanda*. In the earthy patches grew *Crocus biflorus* ssp. *crewei* with occasional plants of *Sternbergia colchiciflora* and *Colchicum burtii*. As I climbed higher to the ridge *C. crewei* gave way to *C. baytopiorum*, which lives on the most exposed and bare rock and gravel. I didn't take any readings (coordinates - J.R.) so I can only guess at how high I was and the orientation was, as I said South West."
I grow two different stocks, both labelled as "*Crocus crewei*" from Honaz-Dağı, collected by Jim Archibald. The label of one stock had an attached slip with words "seeds buff" and about this one he wrote: "…place was Kiziljilobuk (this should read Kizilcabölük – J.R.) just NW of Tavas. There is a television tower there and a service road leading from Tavas. There were many interesting plants there

 ISSN 2053-7557

but just below the tower, about 200 metres, on a north facing bank by the side of the road was a big population of *biflorus*. Some were identical to *crewei*, some were stippled and some suffused light blue. Again *C. baytopiorum* was on the top and below them, a great form of *C. pallasii*." Later I got both of these crocuses from Jim's widow Jenny according to his last wish. Originally this crocus was found already in 1986 by Norman Stevens. Jim Archibald and Norman returned to the same spot in 1994. The upper areas of those mountains are now under military control, in other words, a no-go area, thus the plants are protected from collecting and that allows me to quote here the exact data about the locations from Jim's letter to me.



***Crocus crewei* 'Hot Chocolate'**

***Crocus crewei* TULA-011**

In late February 2011, together with a few friends, I researched the crocuses around Denizli following advice from Ibrahim Sözen, local amateur botanist and a great crocus enthusiast. There we collected several samples of the typical *Crocus crewei*, among them were a few plants with entirely deep purple brown backs of the flower segments, which Ibrahim had named **'Hot Chocolate'**. Another sample I got from Erich Pasche (HKEP-0204). They all – mine and the one collected by Kerndorff and Pasche – were identical and in all features turned out to be the true *C. crewei*. When all these gatherings were planted alongside in the greenhouse, it became evident that both Archibald stocks differed notably from the true *C. crewei* although they were collected in the same region.

Far left: *Crocus stevensii* first Archibald form
Left: *Crocus stevensii* with buff seeds, second Archibald form

The only features separating the two stocks of Jim Archibald are the flower colour and the seed colour. Though the variability of the flower colour is somewhat similar to that of *Crocus crewei* they are very well separable by the width and morphology of the leaves. In the crocuses received from Jim the leaves are almost twice as wide

ISSN 2053-7557

as in the true *C. crewei*, they are more silvery greyish, and most importantly – have twice as many ribs in lateral channels. These features are important when distinguishing species in the former "*biflorus*" group. There are not so many species with so many ribs in each lateral channel. Also the anther colour is different. In *C. crewei* anthers are distinctly black, while in the new species only the connectives are greyish tinted, very rarely entirely. I decided to name the new crocus after Norman Stevens, a long-time travel partner and friend of Jim Archibald, who found and later together with him collected this marvellous crocus, as *Crocus stevensii*.

Crocus stevensii **Rukšāns species nova.** Type: ex culturae in horto Jānis Rukšāns.

(Plants from S.W. Turkey, Honaz Dağı, over vil. Honaz, alt.1650m *J. Archibald*.). Cultivated plants collected on 29.02.2016. Holotype: GAT.

Above: ribs in lateral channels of *C. stevensii* leaves
Left: *Crocus stevensii*
Below: *Crocus stevensii* corm

Habitat and distribution – open sites near the tree line, in stony clay over limestone, at an altitude of 1650m. Originally collected by Jim Archibald and Norman Stevens on Honaz Dağı, Turkey.

Flowering time – February to March.
Corm – subglobose, slightly depressed, up to 15mm in diameter.
Tunics – very hard, coriaceous.
Tunic neck – up to 5mm long, formed by broad-based gradually tapering triangles of the main tunic splits.
Basal rings – 2-3, very hard, upper edges with very short (less than 0.5mm long), slightly distant teeth.
Cataphylls – 3-4, whitish or greenish, somewhat translucent, with or without darker longitudinal veins.
Prophyll – absent.

ISSN 2053-7557

Leaves – invariably 3-4, silvery green, glabrous, 3-3.5mm wide, with 4-5 ribs in lateral channels, the white stripe ~ 1/3 of the leaf width; mostly reaching the tips of the flowers at blooming time, sometimes remaining below them.
Bract and bracteole – present, silvery, well exerted from the cataphylls and reaching almost the middle of the flower tube, bracteole much narrower, ligulate.
Perianth tube – at the base white, striped or suffused purplish in the upper part.
Throat – glabrous, bright orange-yellow, becoming yellowish at the rim.
Filaments – 8-11mm long, nude, orange.
Anthers – 10-11mm long, yellow, wide, in the upper third gradually narrowing to subacute tips with a minor notch in the middle.
Connective – very prominent, wide, whitish to grey or bluish grey, mostly on the edges bordering the pollen sacs, sometimes entirely greyish or greyish only at the tips.
Style – divided more or less at the middle of the anthers or slightly higher into three, orange to red, spreading, 6-10mm long branches, distinctly widened, trumpet-shaped and frilled at the apex; stigmatic branches mostly end around the tips of the anthers, sometimes slightly lower or higher.
Flower segments – obovate to oblanceolate, with obtuse to subacute tips, rarely acute, inside light bluish, sometimes darker at the tips, occasionally pure white or with translucent outer stripes on the outer segments.
Outer segments – 27-**32**-37mm long and 10-**13**-15mm wide, outside whitish, light bluish or buff-tinged and feathered with rich purple markings, sometimes stippled and dotted grey to purple, or rarely the markings confluent making the segment exteriors dark purplish violet with a narrow white edge.
Inner segments – 24-**30**-35mm long and 11-**16**-19mm wide, outside white to light blue, darker at the tips, with a narrow dark greyish or purplish basal blotch surrounded by or along the sides with a diffused yellow zone shining from the throat.
Seeds – 3mm in diameter, purplish red or buff.
2n = ?

Crocus stevensii grows readily in my collection and sets seed well, but I have not yet plucked up enough courage to try it outside. In its homeland summers are dry and hot, so I leave it in the greenhouse during summer months. Its seedlings mirror the parents and no crossbreeding with other species was observed, so this alone confirms the relevance of species status for *C. stevensii*.

Crocus stevensii variations

ISSN 2053-7557

Another species was collected on several occasions in the opposite corner of Turkey – near the Sakaltutan Geçidi in Erzincan Province in NE Turkey. First visits there were in 2004 and 2005 together with botanists from the Gothenburg Botanic Garden and later again with a group of friends in 2009. All these visits were made on the way to the highlands in NE Turkey at the end of May or in June, when crocuses on the Sakaltutan mountain pass had already ended blooming. The plants were collected on both sides of a gently sloping valley although the actual reason we stopped there was the very bright blotches of a marvellous *Muscari sp*. (most likely an unpublished new one) blooming almost out of water on an extremely wet meadow together with *Colchicum szovitsii* (?). Higher up the slopes, in dry spots, I found some crocuses, with semi-dry leaves. When they first bloomed with me the flowers caught my eye with the very uniform colour and shape – their segments were very bright, narrow and unusually elongated. The look is so special that I recognise these stocks at a glance.

***Crocus sakaltutanensis* BATM-301** ***C. sakaltutanensis* LST-185** ***C. sakaltutanensis* JRRK-011**

Crocus samples were gathered there on three occasions (BATM-301, LST-185, JRRK-011), always out of flowers, so the gatherings can be regarded as very randomized. Each time only 5-7 corms were collected, the total number was 19 and the most surprising thing was the great uniformity of flowers, practically without any significant variation.

There are several other gatherings from more or less distant localities in the same region. In overall colouring they are rather similar, but the flowers in general are shorter with less uniformity in colour, with some lighter bluish individuals and a few with striped flowers, however, their identity or dissimilarity with the crocuses from the Sakaltutan Geçidi can be confirmed only by DNA analyses. According to Kerndorff & al. (2013B), in this region are distributed crocuses that belong to two different groups – E. & N.E. Anatolian cluster (Pontic group) and to *adamii*-west cluster, but the attached map and provided information about the locations are so inexact that it is impossible to relate the crocuses found by our team to any of those clusters Following the recommendation of Prof. Osman Erol, of Istanbul University, who has discovered many new crocus species and made a great contribution with the development of a new approach of how to show crocus plants in the smallest details, I decided to name the new species after mountain pass where it was discovered as ***Crocus sakaltutanensis***.

ISSN 2053-7557

Crocus sakaltutanensis JRRK-011 corms

***Crocus sakaltutanensis* Rukšāns – species nova.** Type: Ex culturae in horto Jānis Rukšāns.
(Plants from N.E. Turkey, Erzincan Province, Sakaltutan mountain pass 39.870523°N. 39.134231°E, alt. 2120m). Cultivated plants originally collected on 28-05-2009, long after blooming, with almost dry leaves (*Rukšāns,* JRRK-011). Holotype: GAT; Isotype: ISTF.

Habitat and distribution – meadows and moderately stony slopes with sparse vegetation, at altitudes of 2000-2200 m, in N.E. Turkey, Erzincan Province. At present known only from the type locality, but might be distributed wider.
Flowering time – March(?).
Corm – subglobose, 11-17mm in diameter.
Tunics – papery, though strong, with several deep, widely spaced splits and occasional irregular much shorter subsplits.
Tunic neck – (7-)10-12mm long, formed by broad-based triangular splits of the main tunic with several deep narrow subsplits from the top.
Basal rings – up to 3, papery, with almost smooth, slightly and irregularly pronged upper rims; rarely occasional, irregular, up to 1mm long teeth observed.
Cataphylls – 4, light green in the upper part.
Prophyll – absent.

ISSN 2053-7557

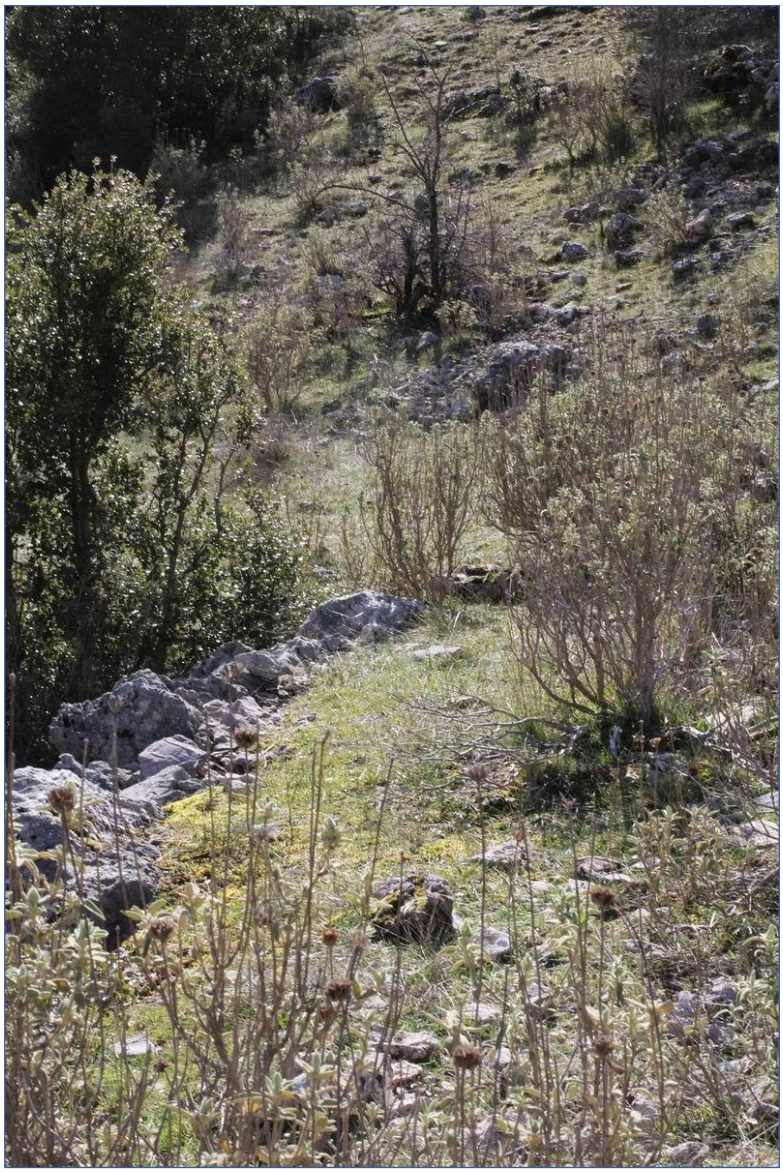
Leaves – 4, dark green, glabrous, with (0)1 rib in lateral channels, 1.5-2mm wide, the white stripe narrow, around 1/4 of the leaf width; positioned well below the flowers at blooming time.
Bract and bracteole – silvery, well exerted from the cataphylls, bracteole distinctly longer and narrower.
Perianth tube – lighter or darker greyish to dirty purplish shaded, rarely striped.
Throat – small, glabrous, yellow, with a diffused rim.
Filaments – 5-6mm long, glabrous, of the same colour as the throat.
Anthers – 10-11mm long, yellow, with 2-2.5mm long pointed basal lobes.
Connective – white.
Style – divided into three 4-5mm long orange to orange-red branches, trumpet-like at the top and with a distinctly fringed edge, positioned below or at the tips of the anthers.
Flowers – very elongated in shape, very uniform in colour at the type locality – when closed – deep lilac, when open – uniformly lilac-blue with no stripes or markings, only slightly lighter at the base.
Flower segments – oblanceolate, rarely narrowly obovate, with acute, rarely subacute tips.
Outer segments – (27-)34-35(-40)mm long and 7-**9**-11mm wide, length/width ratio = 3-4.75 (n=17), outside uniformly deep lilac, sometimes with a very narrow white edge and very indistinct veining; basal blotches indistinct or flushed greyish over the translucent yellow throat colour.
Inner segments – (25-)31-32(-38)mm long and 7-**9**-11mm wide, on the outside much lighter than the exterior of the outer segments and only slightly darker than the inside; basal blotches slightly smaller, sometimes with a diffused bluish midvein and a diffused bluish rim.
Capsule and **seeds** – not observed.
2n = ?
In cultivation *Crocus sakaltutanensis* has proved to be easy, sets seed well and multiplies by corm splitting. It grows only in pots in the greenhouse, stays there all the time for the summers in its homeland are hot and dry.

In his famous Monograph (1982) Brian Mathew wrote: “Before the next subspecies, mention must be made of a Crocus which grows in the N. Peloponnese but which does not agree in its characters or habitat with subsp. *sublimis* [at that time B. Mathew widely used the subspecies rank for the taxa now regarded as species - J.R.]. In 1966 I collected some corms of a Crocus (Mathew 5071) near Langadia [also Lagkadia - J.R.] which I took to be *C. cancellatus* [now *C. mazziaricus* - J.R.] because of their coarsely netted corm tunics and narrow leaves. However in the following year both the autumnal *C. cancellatus* and a spring flowering one appeared in the batch of corms, the latter bearing some resemblance to *C. sieberi* [now *C. sublimis* - J.R.]. … This “species near *sieberi*” has a reticulated corm tunic, much coarser than that of *C. sieberi* subsp. *sublimis* and very narrow erect leaves with ribs in the grooves on the underside – a character not associated with *C. sieberi*. The flowers, produced in spring, are lilac with a paler, slightly silvery exterior to the outer segments and the pale yellow throat is pubescent. In overall appearance it is thus different to the broad leaved tricoloured *C. sieberi* variant which grows nearby in damp wooded areas; the habitats of the two are quite different, for the narrow-leaved one grows in scree-like conditions.”
This account so intrigued me that I right away made up my mind to go on a trip some time to the surroundings of Langadia in search of this very special crocus. I asked Brian for additional information and he sent me an excerpt from his diary: “In a village, picked up a priest & took him to Langadia. Very chatty & smoked all the way. He blessed me on my way and then I climbed a high pass out of the village [i.e. Langadia]. Looking back on the village was beautiful. Odd shale rock – found *Crocus* & *Ornithogalum* in quantity. Higher up went into thick *Abies* forest & found 3 *Crocus* spp. in damp grass. Dropped slightly and in deciduous woods found another *Crocus* – probably *C. sieberi* of sorts.”
I shared these facts with my Greek correspondent, Professor George Papapolymerou, great enthusiast of the wild flora and especially crocuses (he often publishes his pictures on the Crocus forum of the SRGC), and he replied that he knew the place well as previously he had spent there holidays together with his family and kindly offered his help in the search for this crocus.

 ISSN 2053-7557

My first attempt to reach the new crocus was made in spring 2015, but then the winter suddenly returned and when I landed in the Athens Airport even the suburbs of the Greek capital were under a deep blanket of snow. I changed my plans and bought flight tickets to the islands of Rhodes and Karpathos, which resulted in the publishing of a new species – *Crocus rhodensis*. In early March of 2016 I repeated the attempt to find the crocus from Langadia. This time I was accompanied by my Czech friends, nature aficionados Vaclav Jošt and Jiŕi Bydjowsky. At Athens Airport we were joined by George Papapolymerou. This year the spring had been early and so we entertained a little hope that we would see blooming plants. Actually we were very lucky – during those few days in the mountains we enjoyed beautiful weather- for the next day, after our departure, it dramatically changed and all the heights where we had searched for crocuses were covered in snow.

On the first day we tried to find the recently described *Crocus flavus* subsp. *atticus* near Athens (a very poor choice of the name because there already exists *C. atticus*). But we were far too late and found only *CC. mazziaricus, olivieri* and *atticus* (from the *C. sieberi* group) with well-developed leaves. I at least got an excellent sample of a perfect *C. atticus* with a very typical long neck of brown dry cataphylls, well separating it from other members within the alliance. By the afternoon of the next day we reached Langadia and booked in at an excellent hotel. I had some heart problems so I took a rest in the hotel but my friends did the first scouting in the surrounding mountains. George brought down for me the first flowering crocus – it was a very typical *C. sublimis* with wide leaves and without any ridges in the lateral channels, but this, if nothing else, confirmed that something still could be in bloom there.



After a good rest, the next morning our small team repeated the climb and the first flowering crocus I spotted in the shadow of a deciduous shrub was just what we were seeking. In total we saw only three blooming plants, all of them on scree but in some shade. The season really had been very early and crocuses had finished blooming some time ago and only the plants in such shaded spots, where most likely snow had remained for longer, still had some flowers. It was easy to distinguish it from the *Crocus sublimis* found occasionally in the vicinity just by the dimensions of the leaves and their morphology. More problematic was the separation from *C. mazziaricus* which was growing next to the new species and had the same shape of leaves. Then there was no other alternative but to check the corm tunics – *C. mazziaricus* has a long and bristly tunic neck formed by coarse fibres, whereas the tunics of the new species are finer and the tunic neck looks differently. All *C. mazziaricus* corms that were by mistake pulled out were carefully replanted thus minimising the damage to the habitat. Further along the road we continued to inspect the forested areas over Langadia and saw that the typical *C. sublimis* was still in bloom.

Habitat of *Crocus georgii*

ISSN 2053-7557

Higher up the slope we found the last flowers of *C. chrysanthus*. So it turned out that there together or in close proximity four crocus species were growing – the well-known autumn-blooming *C. mazziaricus* and the spring-blooming *C. chrysanthus, C. sublimis* and the new species that is described here. I decided to name it, after academician and professor of three universities, George Papapolymerou, who assisted greatly in the searching for and finding of this new species, as *Crocus georgii*.

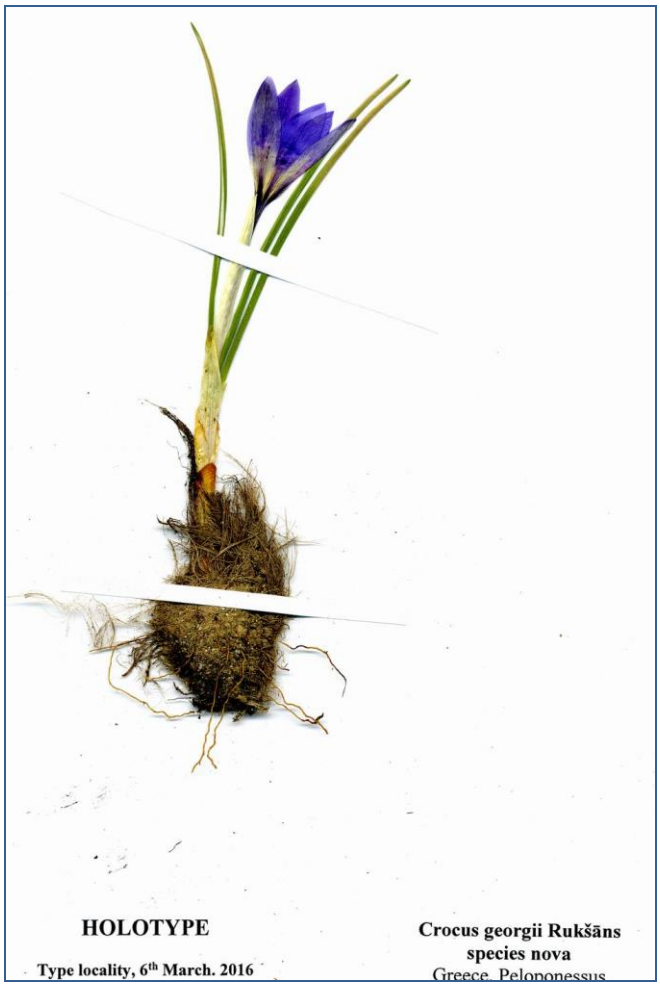
Crocus georgii occurs on upper screes while *C. sublimis* is found under still leafless deciduous trees and occasionally under pines.

Crocus georgii* Rukšāns *species nova. Type: Greece, Peloponnese, over Langadia (37.687578° N, 22.031690° E), on scree between and underneath dwarf shrubs at an altitude of 1140m, 06-03-2016. *Rukšāns* (16GRS-010). Holotype: GAT.

Habitat and distribution – at altitudes from 1100 to 1200m, known only from the type locality where it grows on open stony screes and between dwarf shrubs together with *C. mazziaricus* and occasionally with *C. sublimis*.
Flowering time – March.
Corm – up to 15mm in diameter, subglobose.
Tunics – finely reticulated (contrary to what is stated by Mathew: “much coarser than that of *C. sublimis*” –it is most likely that Mathew characterises the tunics of *C. mazziaricus*).
Tunic neck – up to 2cm long, formed by extended persistent and interwoven fine fibres of the main tunic.
Basal rings – absent.
Cataphylls – 4, the lower – brownish, the upper – slightly greenish white.
Prophyll – absent.

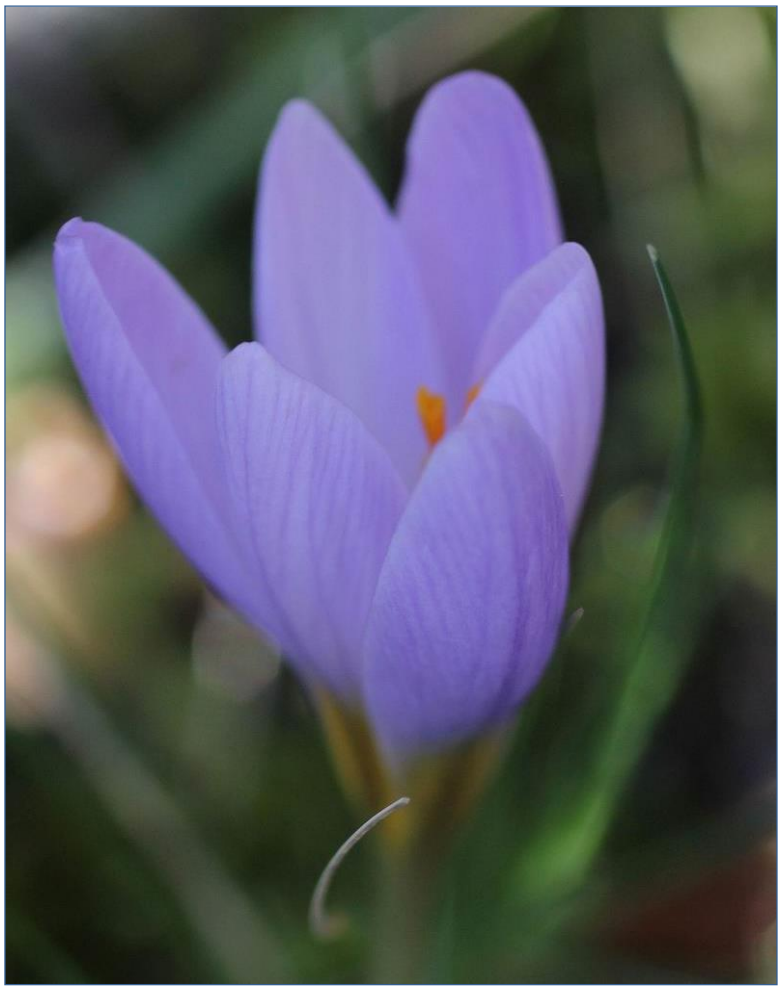
ISSN 2053-7557

Leaves – 3-4(-6), dark green, papillose along the edges and sparsely papillose on the lamina, 1-1.5(-2)mm wide, with (1)2 ribs in lateral channels, the white stripe variable from 1/4 to 1/3 of the leaf width (n=20); in the observed flowering individuals (n=3) reaching or overtopping the flowers at the end of anthesis.
Bract and bracteole – white, sometimes slightly greenish shaded, well exserted from the cataphylls and reaching the flower base, bracteole narrower.
Perianth tube – white, tinged lilac below the segments.
Throat – pubescent, pale to medium yellow, becoming lighter at the rim.
Filaments – up to 10mm long, glabrous.
Anthers – slightly longer than the filaments, yellow.
Connective – not observed.
Style – divided into three short, slightly expanded orange branches, fringed at the tips, level with the anthers or exceeding them.
Flower segments – obovate to sublanceolate, with pointed or subacute to rounded tips, inside light lilac, the same in both whorls.
Outer segments – around 30mm long and 9mm wide, outside silvery lilac without stripes, lighter than the inside or of the same colour.
Inner segments – slightly shorter (29mm) and wider (10mm), the outside of the same colour as the inside; if the exterior of the outer segments is of a lighter shade, then the inner segments are darker tinged, but can be of the same colour, too.
Capsule and **seeds** – not observed.
2n = ?



Crocus georgii in habitat left, and holotype sheet, right.

ISSN 2053-7557



Crocus georgii

As we found only the last flowers and only three of them were in state to be examined and used for a herbarium, the characters of this species certainly will be fine-tuned in due course after the evaluation of the gathered specimens (10 pcs were collected) and further field observations. But even if the material consists of only 3 plants, the crocus found by our team (following in the footsteps of Brian Mathew) is so distinct from its allies and is easily identifiable that there is no doubt that it is something different.

Here is the **key for the spring-blooming crocuses from the *C. sieberi* alliance**.

1. Corm tunics coarsely reticulated
    2. Corm tunics with a long brown persistent neck of old sheathing leaves — ***C. atticus***
    2. Corm tunics without a long persistent neck
        3. Throat sparsely pubescent, yellow — ***C. dalmaticus***
        3. Throat nude
            4. Tunic neck absent, leaves up to 5 mm wide — ***C. athous***
            4. Tunic neck 2-3 mm long, bristly, leaves 2-3 mm wide — ***C. rujanensis***

1. Corm tunics finely reticulated
    5. Throat glabrous
        6. Leaves up to 2 mm wide, segment exterior white, usually stained purple or with a central longitudinal stripe, or broad horizontal bands — ***C. sieberi***
        6. Leaves up to 6 mm wide, flowers entirely lilac-blue — ***C. nivalis***
    5. Throat pubescent
        7. Leaves 3-4 mm wide, without ribs in lateral channels — ***C. sublimis***
        7. Leaves up to 2 mm wide, with (1)2 ribs in lateral channels — ***C. georgii***

I have no experience in the cultivation of *Crocus georgii* but judging by its allies which all are very easy in the garden and in the greenhouse, there should be no difficulties with its growing, providing there is much sun and good drainage.

J.R.

ISSN 2053-7557

Acknowledgments

First of all I want to express my thanks to the late Jim Archibald, who sent me at first seeds and, later on, a lot of crocus corms from the locations I had never visited. My thanks also go to Brian Mathew, who shared information with me and inspired me in my researches; to Dörte Harpke (The Leibniz Institute of Plant Genetics and Crop Plant Research, Gatersleben) for informing me about the DNA analysis; to Henrik Zetterlund (Gothenburg Botanical Garden, Sweden) for sharing the living material and for arranging trips to Turkey; to Dima Zubov for his help during the trips in Ukraine; to Zhirair Basmajyan in Armenia, George Papapolymerou in Greece and to all the others who assisted me in my trips. Also, a big thank you to all who shared with me their gatherings, information and ideas. I am especially thankful to my family for the help and patience when I was away on my trips and during the preparation of my publications. J.R.

References

Archibald J. Master List: Complete European, West Asian & North African Reference. 339 pages: SRGC Archibald Archive.

Brighton, C. A., Mathew, B., Rudall P. 1982. A Detailed Study of *Crocus speciosus* and its ally *C. pulchellus* (Iridaceae). Pl. Syst. Evol. 142: 187-206 (1983).

Harpke D., Peruzzi L., Kerndorff H., Karamplianis T., Copnstantinidis T., Ranđelović V., Ranđelović N., Jušković M., Pasche E., Blattner F.R. 2014. Phylogeny, geographic distribution, and new taxonomic circumscription of the *Crocus reticulatus* species group (Iridaceae). Turk. J. Bot. 38: 1-23.

Harpke D., Carta A., Tomović G., Ranđelović J., Ranđelović N., Blattner F., Peruzzi L. 2015. Phylogeny, karyotype evolution and taxonomy of *Crocus* series *Verni* (Iridaceae). Plant Syst. Evol. (2015) 301: 309–325.

Kerndorff H., Pasche E., Blattner F., Harpke D. 2013A. A new species of *Crocus* (Liliiflorae, Iridaceae) from Turkey. Stapfia 99: 141-144.

Kerndorff H., Pasche E., Blattner F., Harpke D. 2013B. *Crocus biflorus* Miller (Liliiflorae, Iridaceae) in Anatolia - Part IV. Stapfia 99: 159-186.

Kerndorff, H., Pasche E., Harpke D. 2014. *Crocus isauricus* Siehe ex Bowles (Liliiflorae, Iridaceae) and its relatives. Stapfia 101: 3-18.

Mathew B. 1982. The Crocus. A Revision of the Genus *Crocus* (Iridaceae). 127 p. London: B.T. Batsford Ltd.

Rukšāns J. 2013: Seven new crocuses from the Balkans and Turkey. – Alpine Gardener 81: 188–193 & Supplement 15 p.

Schneider I. 2014. *Crocus brachyfilus* (Iridaceae), a new species from southern Turkey. - Willdenowia 44: 45-50.

Scottish Rock Garden Club Crocus forum.

 ISSN 2053-7557