

# International Rock Gardener

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Jānis Rukšāns and Dimitri Zubov bring four new crocus species to IRG readers this month. One growing wild in Mainland Greece and three new *Crocus* species from Western Turkey are described and illustrated. The differences between new species and related taxa are discussed. We are indebted to these independent researchers for their efforts to bring further light on the genus.

The second article is from the American, Robert Barnard. Robert has his home garden in Sacramento, while his family farm is at Placerville, Northern California. Robert is passionate about ecology, preserving native ecosystems and doing everything possible to re-balance our climate. He is distressed by the number of invasive plants interfering with natural environments in California.

He and his wife Jasmin enjoy lots of Californian native plants, many of them annuals, in their home garden. Robert grows many plants from seed, raising by each generation, strains that work well in



a garden situation while keeping their natural attributes.

Robert describes his use of soil blocking moulds to simplify and improve his success with seed sowing. Used for a long time in horticulture such moulds, mostly of robust zinc-plated steel construction, create individual blocks of soil with indentations for each seed, eliminating pricking out and providing a high rate of germination and an easy route to blooming.

Photo by Robert Barnard from SRGC forum of *Clarkia gracilis* subsp. *traceyi*

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## --- Species Descriptions ---

### **Four new *Crocus* species (*Iridaceae*) from Mainland Greece and Western Turkey**

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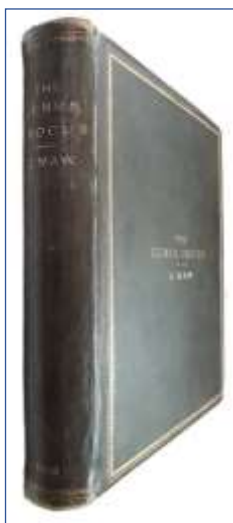
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**Summary.** New *Crocus* species growing wild in Mainland Greece (Viotia Prefecture) and three new *Crocus* species from Western Turkey are described and illustrated, the differences between new species and related taxa are discussed. Photographs, distribution maps are provided.

**Key words.** Geophyte, genus *Crocus*, Flora Hellenica, Flora of Turkey.

#### **Introduction**

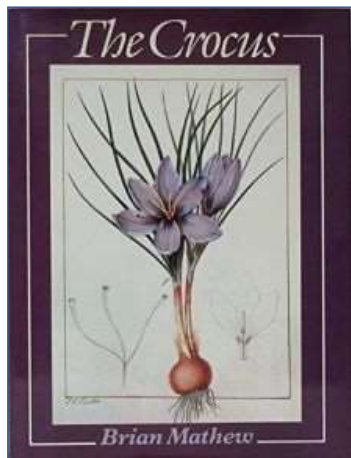


Crocuses are the most popular among early spring blooming bulbs due to profuse bloom, bright colours and significant morphological variability. It seems that they belong to the most studied genus among the other spring geophytes resulting in numerous articles published in scientific and gardeners' periodicals and several monographs dedicated to this genus *Crocus* L. One of the first fundamental works which has not lost scientific importance is a monograph published in 1886 by G. Maw and this is still widely used for the identification and characterisation of crocus species known at that time.

The next important contribution followed in 1924 from E. A. Bowles, who published "A Handbook of Crocus and Colchicum" with revised re-edition in 1952. It was a real handbook for all crocus lovers stuffed with a lot of information about crocus variability, their growing history and important information about habitats and taxonomy of different species. For many years it (as well as 3 other's Bowles' books – "My Garden in Spring", etc.) was our everyday manual for crocus growing.

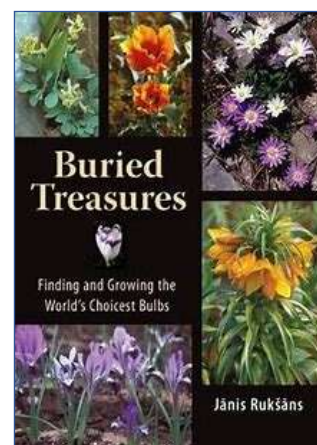


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The real break in scientific aspects of the genus *Crocus* appeared in 1982 when Brian Mathew published his monograph "The Crocus". It gave a modern view on *Crocus* systematics, description of 80 *Crocus* species recognised at that time together with growing hints based on own experience and data from other authors. There had been no such comprehensive work published since the time of Maw. Brian Mathew highlighted several taxonomic problems not yet resolved by him, opening way for other researchers. From the time when the monograph of B. Mathew was published science made great step ahead and a lot of new methods were introduced by research on plant taxonomy, especially using molecular and genetic methods. Those works allowed serious revision in crocus taxonomy and their classification to be made. The greatest involvement in those studies was done by researcher team working in Gatersleben's Institute of Plant Genetics in Germany. Dörte Harpke, Helmut Kerndorff and Erich Pasche have not only discovered and published a lot of new crocus species but also started working on a revision of *Crocus* systematics. Their studies sometimes showed admirable things about relations between species, allowing the preparation of new groups of species in series, publishing new series, etc. This job was not completed and discovering and publishing new species continue.

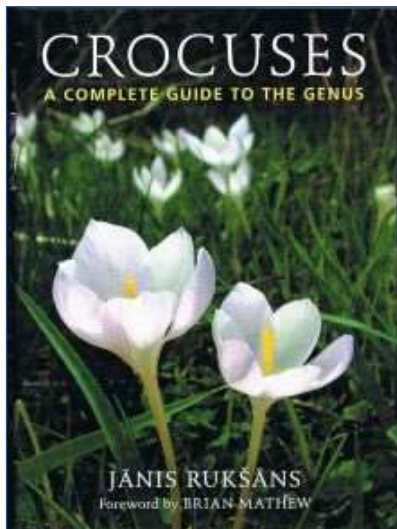
In 2007 the American publishing house "Timber Press" issued the Rukšāns book "Buried Treasures" about his travels in search of plants. The great success of it has encouraged them to offer Jānis work on another book about crocuses. When he agreed to this he couldn't imagine how difficult a task he undertook. Just working on its manuscript, he understood how many things still remain unknown and this work pushed him to look deeper in his own crocus collections. The new book (published in 2010) was directed to crocus lovers, ordinary gardeners, mostly amateurs and so in arrangement of text he followed steps of E.A. Bowles. At the same time it became clear that there still was a lot of material left out of the book due to the size, lack of information, etc. The New Millennium really exploded by discoveries of new crocus species and greatest part of them (more than 60) were published just by aforementioned team from Gatersleben. A lot of new species came from other researchers, among them almost 50 new species were discovered and published by J. Rukšāns.





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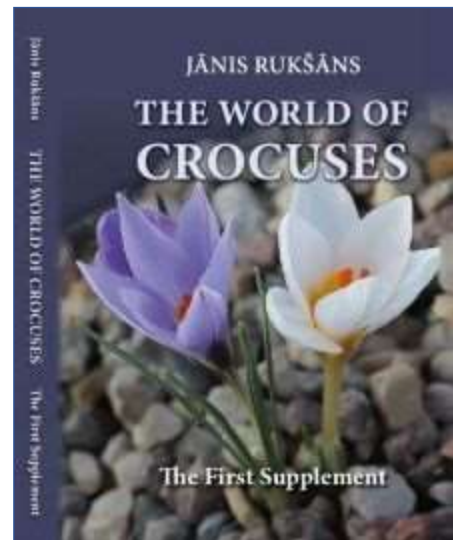
Therefore, there was a need for a new complete book about all crocus species known at that time and such a book was published 8 years later by Latvian Academy of Sciences. When deciding about the arrangement of species the author had a dilemma – to use taxonomic approach or make it more user-friendly and just to arrange all species in their alphabetic



order. Finally, he decided to make the alphabetical order due to two aspects, at first a new system is still not published and a work on it continues (and most important, these were not Jānis' own studies, but done by other scientists), and the alphabetical order makes the text more like an encyclopaedia allowing ease of finding each taxon without constant access to an Index. Included are the detailed descriptions of 230 crocus species known at that moment and the notes about some samples insufficiently explored at publication time are highlighted.

In 2023 "The First Supplement" was published, where an additional 30 species and 1 hybrid were included (giving also some corrections for the main volume and some more growing hints).

The crocus explorers have not stopped and after publishing "The First Supplement" two new species have already been described and published and several are in preparation by different researchers. In our own collections there still remain a lot of unidentified crocus samples where more research is needed, but the working capacity is limited, and last spring we gave most attention to resolving some problems known already from the time when B. Mathew's monograph was published as well as to the description of few new taxa discovered by ourselves during last decade (and these were not only crocuses).



### **New crocus species from Mainland Greece**

In 1982, when B. Mathew published his monograph, under the name of *Crocus sieberi* (L.) J. Gay there were given 4 subspecies – the type subspecies *sieberi*, and three more – subsp. *atticus* (Boiss. & Orph.) B. Mathew, *nivalis* (Bory & Chaub.) B. Mathew and *sublimis* (Herb.) B. Mathew. The modern approach in *Crocus* taxonomy doesn't accept subspecies

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range and all former subspecies were raised to species rank by most researchers. Now it became clear that true *C. sieberi* is narrow Cretan endemic distributed only within this island in three general localities at 1500-2700 m elevation; *C. nivalis* is known from Taygetos Mountains in S Peloponnese; *C. atticus* has wider distribution and was found within Attica peninsula, Andros Island and S Euboea Island. The most widely distributed is *C. sublimis* which, according to B. Mathew, is growing within mainland C & N Greece, N Peloponnese, on Euboea Island, Cephalonia Island, as well as in the Republic of North Macedonia, S Bulgaria and S Albania. Plants from Athos peninsula, described as *C. athous* Bornm., were considered by Mathew conspecific with *C. sublimis*. Rukšāns' studies on Athos peninsula confirmed that J. Bornmüller was correct in separating it from other species belonging to *C. sieberi* group and it is sufficiently different from its allies by several essential morphological features to be regarded as a different species.



Figs.: 01 *Crocus sieberi*.



02 *Crocus nivalis*.



03 *Crocus atticus*.

In his monograph B. Mathew wrote that in 1966 in Peloponnese near Langadia he collected some crocus corms which by their corm tunics and foliage (having ribs in lateral channels) looked like autumn blooming *Crocus cancellatus* Herb. (now *C. mazziaricus* Herb.). How great was his surprise when some of those corms bloomed in spring. According to B. Mathew: “A further collection has been made in the same area by P.J. Christian.” Brian Mathew characterized some essential features separating this crocus from *C. sublimis* growing in the same area and noted that “field studies are required before a decision can be made about this plant”. This inspired us to visit a locality and after correspondence with B. Mathew, he sent Rukšāns notes from his diary about his visit to Langadia area. Our travel there resulted in finding a really new species published later as *C. georgei* Rukšāns.

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In 2009 Rukšāns bought few corms of crocus labeled as *C. sublimis* PJC-215 (PJC is abbreviation used by Paul John Christian for his collections during his field trips) from the Buried Treasure nursery run by Robert and Rannveig Wallis. It was reported as coming from Langadia and had super-fine corm tunics. A year later Rukšāns got stock of crocus according to the wish of Jim Archibald who died in 2010. It was labeled as "*C. sublimis*, Parnassos". In "Complete Master List of Archibald's collections" there is listed the sample of *C. sieberi* subsp. *sublimis* 352.552 from "Greece, Viotia, Oros Parnassos, 1500 m". Following a spring it turned out that both stocks – PJC-215 and Archibald's from "Parnassos", - were practically identical. This confused us, because when in Langadia we found nothing similar to those plants and both areas were very distant and belonged to different mountain systems. In spring 2022 we revisited Langadia, and shortly before we found that there is another "Parnassos" located only 12 km to the south-west of Langadia. As on Archibald's label it was only "Parnassos" without more detailed indication, it looked that it was more likely Archibald's plants came from the same region, from another "Parnassos" than from the famous ski-resort in Viotia.

Unfortunately, spring season was early there, and we came too late to see crocuses in bloom. In Langadia all plants checked had coarse corm tunics having nothing similar with that observed in stock PJC-215. The Peloponnesian Parnassos is surrounded by even lower mountains and vegetation was so rich, that not one crocus was found there by our team. To check this enigma we turned to Bob Wallis asking about exact origin of sample received from him. Bob informed that "*sample PJC 215 came from ex nurseryman, Ron Beeston in the late 1990s. Ron is no longer alive so I don't know where he got it from, and I can't verify the origin, but Jim Archibald has not listed this accession*". After that we turned to original collector Dr. Paul Christian. And his reply cleared up the situation. Although his trips to Greece happened around 50 years ago, he still has travel notes about the places visited and plants collected there. He wrote that: "*PJC-215 is a very old one but I still have handwritten notes. It is however not from Langadia. In 1978 we did travel along the Langadia pass, but I have just checked my notes and it seems we didn't collect anything there. PJC-215 was collected 9th April 1978 and registered as "Crocus sieberi atticus? 20 Km from Delphi along Ski Club Road from Arachova. At edge of melting snow under Pinus or in full sun. Enormous colonies in deep wet terra rossa soaked by the melting snow. Flowers variable from large, pale violet to small, dark blues. No whites found. Growing mostly in full sun."* Of course, *taxonomy has changed since these were written.*" Paul Christian revisited the locality on the 20<sup>th</sup> May 1987, and observed the same crocus, expressing idea that this could be a natural hybrid between *C. veluchensis* Herb. and *C. sieberi*. Jim Archibald's stock from Mt.



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Parnassos was collected on the 7<sup>th</sup> June 1996 on a slope below the fir forest just after snow melt and had lilac blue flowers with yellow throat.



04



05



06

Figs. 04, 05, 06 above: *Crocus sublimis* in Ruksan's garden, *Crocus athous* on slopes of Holy Athos Mountain, *Crocus georgii* at Langadia, Peloponnesse.



07 Jiri Bydzowsky and George Papapolymerou at Langadia.



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08 *Crocus pilousii* PJC-215 from Mt. Parnassos.



09 *Crocus pilousii* from Jim Archibald.



10 *Crocus pilousii* from Jim Archibald.



11 *Crocus pilousii* PJC-215 from Mt. Parnassos.

It turned out that both samples – those of P. Christian and J. Archibald - were originally collected on the same mountain and this explains practical identity of both gatherings divided in time by 21 years. As independent researchers, we have no access to molecular & genetic analysis tools, so it remains for us to check morphological characters, habitat ecological conditions and stability or splitting of morphological features in following generations. As a rule, F1 hybrids are very uniform, and splitting happens starting from F2 generation and further. Regular sowing of both samples showed again their seedling progeny was very stable and varied only in amount of yellow colouration in flower's throat, which is

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very usual for the genus *Crocus*. The main feature – silky very finely reticulated corm tunics versus distinctly more coarser tunics in other related species, remained very constant. This allowed us regarding crocuses collected independently by P. Christian and J. Archibald on high mountain meadows of Mount Parnassos in wet terra rossa soaked by melting snow near *Abies cephalonica* Loudon forest as a new, earlier unrecognized species, which we describe here below.

### ***Crocus pilousii* Rukšāns & Zubov *sp. nov.***

**Type:** Greece, Viotia Prefecture, alpine meadows on Mount Parnassos, in deep wet terra rossa soaked by the melting snow near *Abies cephalonica* forest, at 1500-1700 m elevation, 38°33'N, 22°34'E; cult. (specimens no. PJC-215 grown in Latvia in the garden of Jānis Rukšāns), fl. 07 Mar 2015, *Rukšāns* s.n.; holotype RIG II! (Herbarium Latvicum BOT-16496).

**Habitat and distribution** – open meadows and forest sides on high altitudes of Mt. Parnassos, Viotia Prefecture, Greece.

**Flowering time** – April-June, depending on snow melt time.

**Corm** – slightly depressed, rounded, up to 15-18 mm in diameter.

**Tunic** – very finely reticulated, even somewhat silky.

**Tunic neck** – short, formed by irregular fibres of main tunic.

**Basal tunic** – undeveloped.

**Prophyll** – absent.

**Cataphylls** – up to 5, slightly brownish white with darker enervation.

**Leaves** – 6-7-8, dark green with minutely papillose edges of lamina and sparse papilla on surface, 3.5-4 mm wide and up to 22 cm long at maturity (in cultivation), white stripe around 1/5-1/4 of leaf width, lamina edges minutely down or down and slightly inward turned, lateral channels widely open without ribs, keel short, base flat or sometimes with slightly outside turned central extension.

**Perianth tube** – white, turning light to deep lilac just below flower segments.

**Bract and bracteole** – equal in length or bracteole slightly shorter, silvery, ending well below base of flowers.

**Throat** – large, lighter or darker pale yellow with diffused whitish upper edge, sometimes whitish gradually turning lilac in upper part, outer segments base nude, inner segments distinctly hairy deep in throat, hairs prominent, long.

**Filaments** – 10-12-14 mm long, nude, pale yellow.

**Anthers** – 8-10-13 mm long, deep yellow, minutely notched at top, basal lobes wide, parallel edged and at bottom abruptly narrowing as triangular tips.



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**Connective** – whitish.

**Style** – at base yellow, turning light orange to top, where divided into three 7-10 mm long fanlike branches, always overtopping anthers.

**Flower segments** – inside lighter or darker lilac in upper half of segment length over diffused whitish edge of yellowish throat.

**Outer segments** – 38-**44.5**-60 mm long and 12-**15.5**-19 mm wide, outside light lilac turning lighter and transforming into pale dirty greenish yellow basal part; inside same as outside, only in throat without greyish dirty bloom.

**Inner segments** – 32-**42.5**-60 mm long and 11-**13.5**-18 mm wide of same colour on both sides and slightly lighter than outer segments.

**Capsule** – light buff, cylindrical, up to 15-17 mm long and up to 7 mm wide, with prominent long peak at top, positioned 4-5 cm over ground level.

**Seeds** – very dark brown, up to 3 mm long and 2 mm wide with well-developed light ochre-yellow, ridge-like raphe and small, indistinct caruncle, testa slightly indistinctly roughed (checked by 40x hand lens).

**2n** = unknown

**Recognition** – easy separable from all species related to *C. sieberi* complex (*CC. athous*, *atticus*, *georgei*, *nivalis*, *sieberi*, *sublimis*) by its very finely fibrous, even silky corm tunics which in all related species are coarsely fibrous.

**Examined specimens** – Type: Greece, Viotia Prefecture, alpine meadows on Mount Parnassos, in deep wet terra rossa soaked by the melting snow near *Abies cephalonica* forest, at 1500-1700 m elevation, 38°33'N, 22°34'E; cult. (specimens no. PJC-215 grown in Latvia in the garden of Jānis Rukšāns), fl. 07 Mar 2015, *Rukšāns* s.n.; holotype RIG III (Herbarium Latvicum BOT-16496).

**Etymology** – named after Czech geomorphologist, Dr. Vlastimil Pilous, great traveller and plant lover, native bulbs are just his skilled hobby. He is a good our friend, who never forgot

to collect for us some seeds of crocuses and other bulbs during his travels.

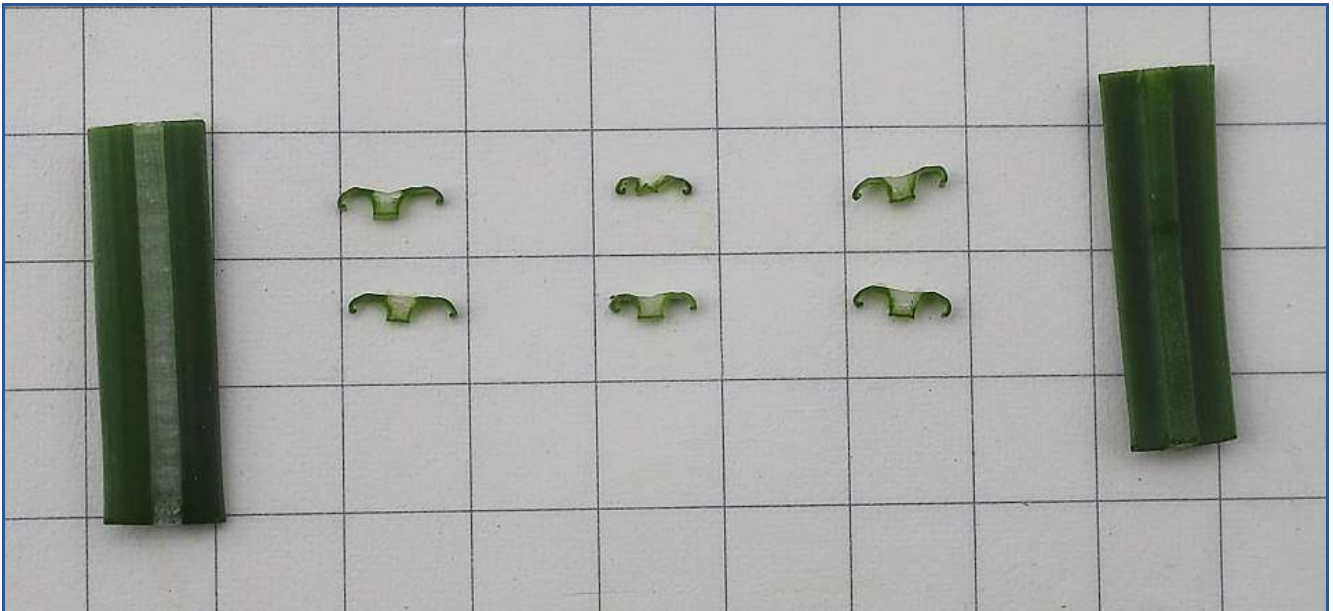


*Crocus pilousii* is a very good grower both in garden and in greenhouse, where it sets seeds well and is a good increaser by corm splitting. It blooms very abundantly during spring-crocus midseason showing large bright lighter or darker violet flowers.

12 *Crocus pilousii* flower.



13 *Crocus pilousii* flower.



13 *Crocus pilousii* leaf morphology.



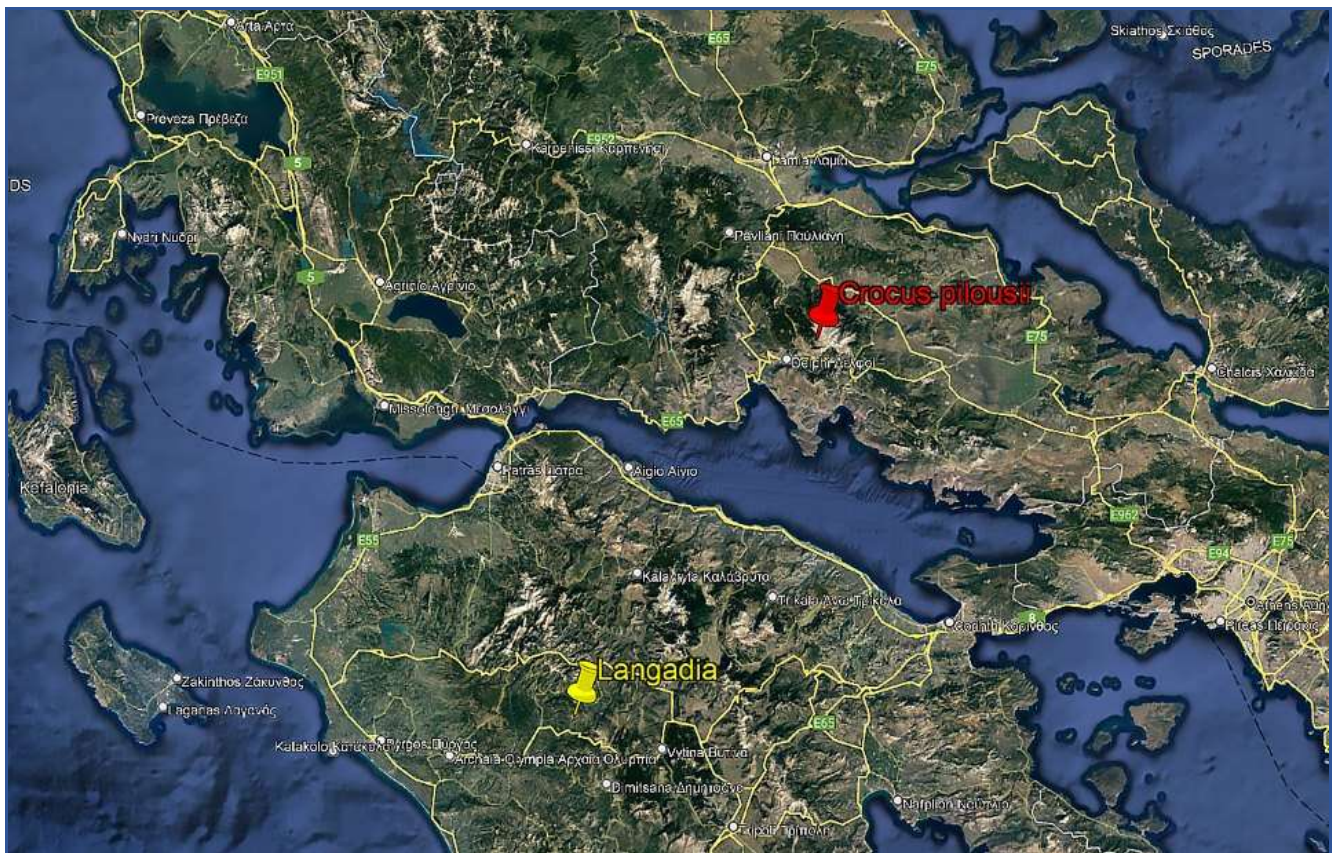
15 *Crocus pilousii* flower details.



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16 *Crocus pilousii* corms



Map 1: Yellow pin - Langadia; red pin - *Crocus pilousii* locus classicus.





16a Holotype of *Crocus pilousii*.



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### New crocus species from Western Turkey

Another species from B. Mathew's monograph we couldn't agree initially with his treatment was *C. gargaricus* Herb. *Crocus gargaricus* by flower is practically indistinguishable from *C. thirkeanus* K. Koch (better known as *C. herbertii* (B. Mathew) B. Mathew), its flowers are to some extent larger and leaves somewhat less developed at anthesis. This similarity caused a lot of confusion and changes in the naming that started with G. Maw and was continued by B. Mathew in their monographs, regarding both as one species. Two years later B. Mathew (1984) agreed that there were two dissimilar taxa and split *C. gargaricus* into two subspecies – subsp. *gargaricus* and subsp. *herbertii* B. Mathew. The molecular and genetic studies revealed that both were really different species. Considering both these as separate species and not subspecies (following new approach to *Crocus* taxonomy) according to the priority rules of nomenclature code *C. herbertii* must correctly be named as *C. thirkeanus*. There are morphological features that satisfactorily separate the two ones, although those are hidden underground: *C. gargaricus* corms never form stolons, but *C. thirkeanus* is a typical stoloniferous species. Their corm tunics differ as well – in *C. gargaricus* tunics are reticulated almost throughout, while in *C. thirkeanus* tunic fibres are parallel fibrous and slightly reticulated only at the top, and corms of *C. gargaricus* are distinctly larger than those of *C. thirkeanus*.



17 and 18 *Crocus gargaricus* at Göktepe.  
Photos Ibrahim Sözen.



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19 and 20 *Crocus gargaricus* in cultivation.



21 *Crocus gargaricus* corms.

22 *Crocus gargaricus* corm tunic.



23 *Crocus gargaricus* leaf morphology.





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24 *Crocus thirkeanus* at locus classicus.



25 *Crocus thirkeanus* R2CV-002 and *C. pulchricolor* R2CV-003.



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Figs. 26, 27, 28 *Crocus thirkeanus* R2CV-002.



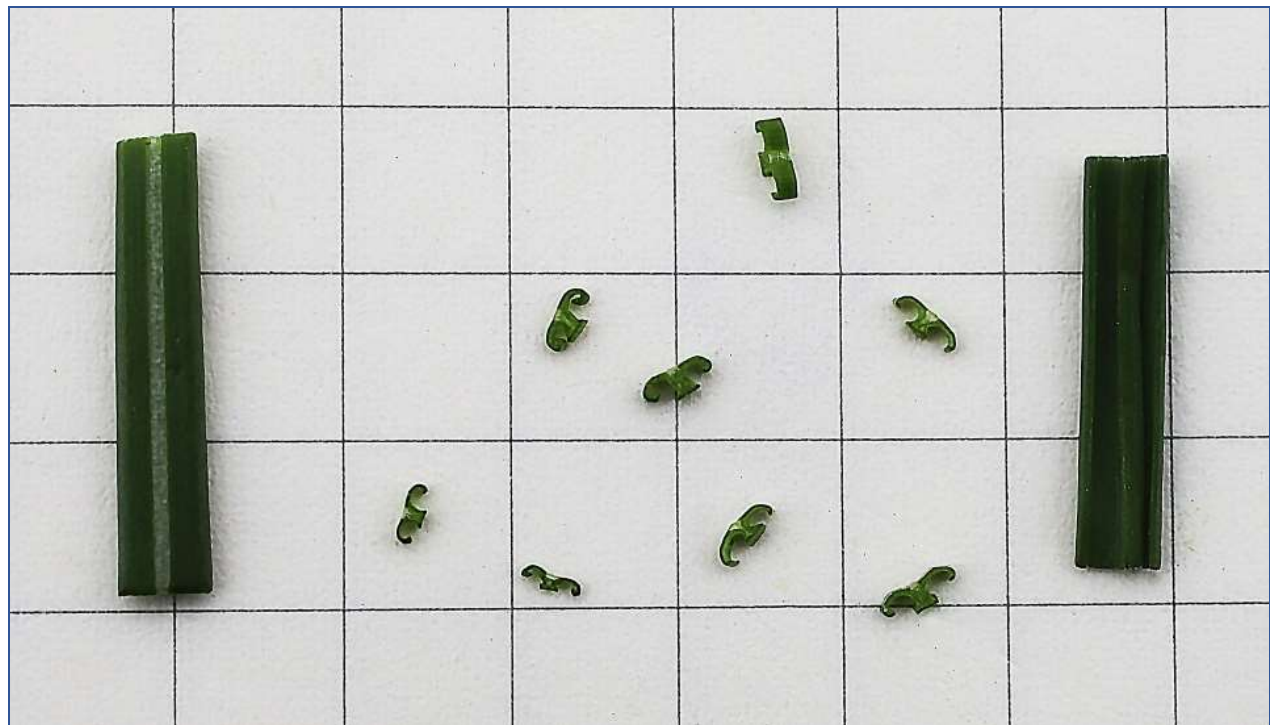
Figs. 29, 30, 31 *Crocus thirkeanus* from Michael Hoog.







32 *Crocus thirkeanus* R2CV-002 corms and stoloniferous cormlets.



33 *Crocus thirkeanus* R2CV-002 - leaf morphology.

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Distribution areas of both species are rather confusing. *Crocus gargaricus* was described from damp pastures and mixed forest edges at 1300-1500 m elevation in NW Turkey – Kaz Dağı Mountain (previously Mt. Gargarus – thus its name) in Balıkesir Province. Later it was found also far to south – on Gök Tepe in Muğla Province where it is growing up to an elevation 2200 m. Our stock of *C. gargaricus* came from Jim Archibald's collection from 1500 m on Gök Tepe, to the north of Muğla, where it was growing on heavy clay in clearings among *Pinus* L. sp. and reported as having no stolons and coarsely reticulate corm tunics. It also seems quite tolerant of drying-off in summer and very hardy with rich orange-yellow flowers in spring. Plants from the type locality on Kaz Dağı seem not to be in cultivation and its area now is a strongly protected Natural Park with very limited access and we never had opportunity to compare both accessions, so it remains to follow B. Mathew and Turkish botanist Adil Güner who consider plants from both populations as identical species regardless of a disjunction between them.

*Crocus thirkeanus* is known better under the name of *C. herbertii* that was used to refer to the stoloniferous form of the crocus previously regarded as part of the *C. gargaricus* complex. Easily separable from the latter by its corm tunics and the stoloniferous habit, it is almost indistinguishable by flowers from *C. gargaricus*. *C. thirkeanus* is known only from Uludağ, Bursa Province. Our team visited its locality in 2008, where we observed it blooming widely in any clearings within forest at 1400-1600 m elevation and locally growing side by side with *C. pulchricolor* (Herb.) Herb. ex Tschich. *Crocus thirkeanus* is very easy in the garden but not too convenient for a nurseryman, just because of its stoloniferous habit and the production of very small cormlets at tips of stolons, which are nearly impossible to collect at harvesting time. What is an obstacle for nurserymen is a great gain for home gardeners. Once planted on a rockery or anywhere else, it can stay there for years, and the spot will slowly grow in size. When after a very harsh winter Rukšāns lost his stock that was planted on open beds, he revisited the long-abandoned garden of his youth where almost 50 years ago he had planted his first corms of *C. thirkeanus* (then received from famous Dutch nursery-man Michael Hoog, co-owner of that time very famous Van Tubergen nursery of rare and exceptional plants) under an old apple-tree and it still was thriving there.

In spring 2013 our small group travelled across the Turkish provinces of Izmir and Manisa looking for the recently described crocus species from this region. On the damp north-eastern slopes of Bozdağ Mountains (Mount Tmolus, or Bozdağlar), close to the border of Izmir Province, we stopped to photograph beautiful clusters of *Crocus* cf. *chrysanthus* (Herb.) Herb. and were greatly surprised when nearby we saw blooming another species, albeit very similar by flowers. Only the checking of its corm tunics confirmed that we had



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found a crocus at that time regarded as a new location of *C. thirkeanus* around 200 km to the south of the type locality. Somewhat higher up to the slope Rukšāns noticed crocuses with white flowers, and his first thought was that it was one of the new “*biflorus complex*” species, but a closer look showed that it was the first pure albino in this uniformly yellow species, as had been assumed before. The stoloniferous habit had allowed this mutation to spread, and it was possible to collect a couple of corms without causing much damage to the habitat. Its flowers are white throughout and only the anthers have retained the yellow colouration, but it turned out to be quite a weak grower in cultivation (at least in pots, where it is still kept due to very small stock) and blooms irregularly due to forming mostly very small corms. It also starts into vegetation and blooming later than the typical yellow form.



Map 2: green pins *C. gargaricus*, red pin – *C. bozdagensis*, yellow pin – *C. thirkeanus*.

Only a few years later when newly gathered stock of so named “*Crocus thirkeanus* from Bozdağ” was well established in cultivation, did we note serious differences between plants gathered from type locality on Uludağ and newcomers from Bozdağ. At first, it was the shape of the flower segments. Typical *C. thirkeanus* has wide, rounded (obovate to oblanceolate, with obtuse or subacute tips) flower segments. The length to width index of



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outer segments in *C. thirkeanus* is around 2.5 but in plants from Bozdağ – 3.5 and even more, its segments are distinctly lanceolate with pointed or quite often something minutely notched tip. Corms of Bozdağ plants are even smaller than those from Uludağ, and they have very fine reticulation almost to base of tunic. Both those features (flower and corm's tunic's shape) together with geographical isolation allow the consideration of the plants from Bozdağ as a distinct species deserving a proper name.



34 *Crocus bozdagensis* – habitat.

### ***Crocus bozdagensis* Rukšāns & Zubov *sp. nov.***

**Type:** Turkey, Manisa Province, north-eastern slopes of Bozdağ Mountains, c. 1000 m elevation, 38°25'N, 28°05'E; cult. (specimens grown in Latvia in the garden of Jānis Rukšāns), fl. 20 Mar 2015, *Rukšāns* s.n.; holotype RIG III! (Herbarium Latvicum BOT-16496).

**Habitat and distribution** – on very wet open slopes at forest edge and sometimes under trees together with *Scilla* cf. *bifolia* L. and *Crocus* cf. *chrysanthus* on slightly dryer spots.

**Flowering time** – March.

**Corm** – up to 5-7 mm in diameter, globose, forming up to three up to 10 cm long stolones with grain-like cormlets on tips and some cormlets attached to base of main corm.



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**Tunic** – only at very bottom finely parallel fibrous, higher turns finely reticulated (versus coarsely reticulated in *C. gargaricus* and finely parallel fibrous with indistinct reticulation only at very top in *C. thirkeanus*).

**Tunic neck** – up to 2 mm long, formed by distinctly outward curved fibres.

**Basal tunic** – indistinct, not developed.

**Prophyll** – absent.

**Cataphylls** – 3, white, upper in highest third greenish shaded, turning darker to top but still light green.

**Leaves** – (2)3-4, up to 1.5 mm wide, glabrous or with very few minor papillae on lamina edges, white stripe 1/3 – 1/4 of leaf width, lamina edges down and inward or sometimes only down turned, lateral channels small, round, without ribs, keel widening at base, base of keel outward turned (convex) with slightly extended central part, less often flat, reaching flower base at anthesis.

**Perianth tube** – light yellow.

**Bract and bracteole** – silvery, ends well below the flower segments base.

**Throat** – nude, yellow, indistinct.

**Filaments** – 5-7-9 mm long, nude, light yellow, at base darker, just below anthers whitish yellow.

**Anthers** – 5-6.5-8 mm long, yellow, mostly parallelly edged, in upper half gradually narrowing with notched tip, basal lobes comparatively long.

**Connective** – yellowish white.

**Style** – yellow, divided into 3 parallel 4-5.5-7 mm long branches slightly below base of anthers, branches slightly diverge only at very top, stigma fan-shaped with hairy edge, ends below tips of anthers.

**Flower segments** – of same colour in both whorls and on both sides, bright orange yellow.

**Outer segments** – 27-30-33 mm long and 5-6-8 mm wide.

**Inner segments** – 21-24.5-28 mm long and 4-5.5-7 mm wide.

**Capsule** – greyish buff turning lilac in upper half and with small peak at top, around 10 mm long and up to 5 mm wide, positioned 1-2 cm over ground level.

**Seeds** – deep purplish brown, elongated, around 1-1.5 mm long and 1 mm wide, with distinct pointed or rounded caruncle, raphe poorly developed, insignificant, seeds surface reticulately wrinkled (checked by 40x hand lens).

**2n** = unknown.

**Recognition** – easily distinguishable from *Crocus thirkeanus* by the shape of the flower segments – length to width index at least 3.5 (versus 2.5 in *C. thirkeanus*), even smaller

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corms with very finely reticulated tunics almost to base (versus reticulation only at tunic top in *C. thirkeanus*), and from something superficially similar to *C. gargaricus* by stoloniferous habitat, much smaller corms and flowers, and distinctly finer reticulation of tunics.

**Examined specimens** – Type: Turkey, Manisa Province, north-eastern slopes of Bozdağ Mountains, c. 1000 m elevation, 38°25'N, 28°05'E; cult. (specimens grown in Latvia in the garden of Jānis Rukšāns), fl. 20 Mar 2015, *Rukšāns* s.n.; holotype RIG II! (Herbarium Latvicum BOT-16496).

**Etymology** – named after Bozdağ Mountains, where it was discovered.



35 *Crocus bozdagensis*.

*Crocus bozdagensis* is not difficult in cultivation. At present it is tested only in pots. Maybe it is not so vigorous and somewhat less floriferous than its relative from a more northern habitat - *C. thirkeanus*. During flowering time, it needs plenty of water and at end of vegetation I bring its pots out of greenhouse to protect against excessive heat. It also seems to be a good grower outside in the garden.

36 *Crocus bozdagensis* - the albino in the wild.





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38 *Crocus bozdagensis*

37 *Crocus bozdagensis* albino, cultivated.



39 *Crocus bozdagensis* flower details.



Figs. 40 and 41  
*Crocus bozdagensis* –  
leaf morphology.

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42 *Crocus bozdagensis* - corms in wild.



43 *Crocus bozdagensis* - corm tunics.



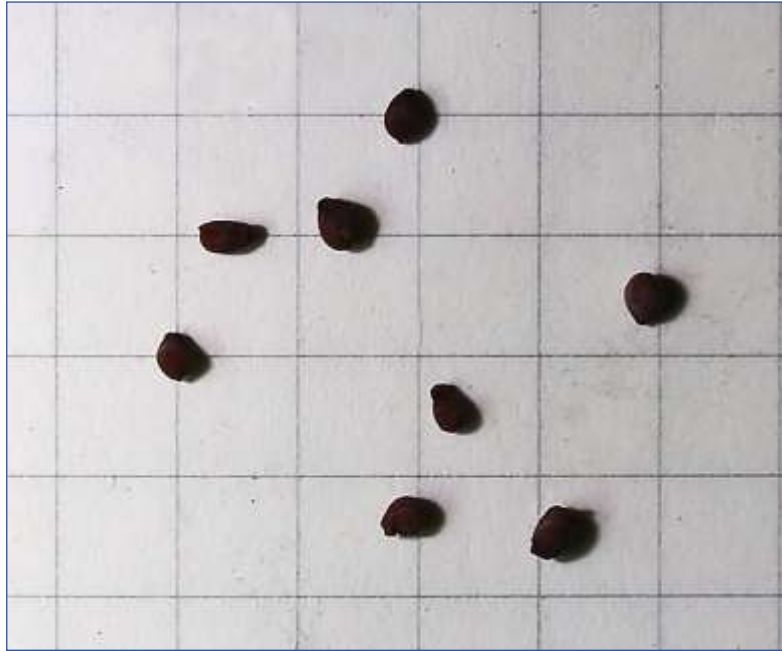
44 *Crocus bozdagensis* cormlets.

45 *Crocus bozdagensis* seedpods.





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46 *Crocus bozdagensis* seeds.

Below: 47 Holotype specimen of  
*Crocus bozdagensis*.



**Holotype  
specimen**

***Crocus bozdagensis*.**  
13TUS-014 - Turkey,  
slopes of Ilisu-dag, alt. 954 m  
38°24'44.9"N 38°03'05"E,  
leg. J. Rukštas 13-03-2013  
det. & leg. c. hietos J. Rukštas 20-03-2023

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## ***Crocus danfordiae* complex species**

*Crocus danfordiae* Maw, according to the Flora of Turkey, has a very wide distribution range. This species is quite unique among crocuses for within the same population one can find blue, yellow and white individuals, although uniformly coloured populations are not rare. Considering the vast area where it occurs in nature, it would be no surprise if several new species had been described in this complex. At present 3 species have already been singled out from this complex, namely *C. kurdistanicus* (Maroofi & Assadi) Rukšāns (Iran), *C. brickellii* Rukšāns and *C. minutus* Kernd. & Pasche (W Turkey). At present in our collections there are grown 28 accessions labelled as *C. danfordiae*, 5 as *C. minutus*, 2 as *C. brickellii* and 1 as *C. kurdistanicus*. On the attached map there are marked the localities from where came the accessions of *C. danfordiae sensu lato* into our collections. The map clearly shows that the crocuses considered as *C. danfordiae sensu lato* constitute 3 geographical groups: orange pins denote the northern populations, red pins – the western populations, and the yellow pins – the eastern populations, while the green pin indicates the population lying somewhat outside the Eastern group. This map, however, does not show the localities of those species already separated from *C. danfordiae sensu lato*. To make the final decision, we must first state the identity of *C. danfordiae* and find where exactly *C. danfordiae fide* G. Maw comes from.

One of the problems with those early described crocus species is the very approximately depicted locality from where the described species came. Quite common it is a situation when only a general area is mentioned, for example, it mentioned only Caucasus or Anatolia and similar, covering huge area where many different and sometimes superficially quite similar species are growing. Descriptions are not always complete and lack a lot of important details used nowadays for separating superficially similar, but in reality different, species. In our research we paid our main attention to flower and leaf morphology, shape of basal rings and to seeds. To check the last, all stocks of *C. danfordiae sensu lato* were artificially pollinated by individual painter's brush attached to each stock, several times during flowering.

Characterising *Crocus danfordiae* G. Maw used plants collected in **Eastern part of Turkey**, at latitudes between 38° and 40° N and along 37° E longitude which responds to our collections from so named Eastern group. At the same time he notes that there is an herbarium sample in Kew, collected in Lycia of what probably is the same species. The last responds to our collections from so named Western group. According to George Maw the corms of typical *C. danfordiae* are round, 13 mm in diam., having coriaceous tunics and hard



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basal disc surrounded by short, pointed rays, followed by 1-2 rings (annuli). Proper leaves are 3-4, 1.3 mm broad, ciliated on the margins of the keel and blade, the keel one-half the width of the blade, **the lateral channel containing two prominent ridges** (accented by us – J.R. & D.Z). Flower throat nude, anthers about 3 times longer than filaments; style short, ends at middle of anthers length, dividing at base of anthers into 3 entire, orange stigmatic branches. Flower segments 19 mm long and 10 mm wide, pale sulphur yellow, occasionally suffused brown on outside, white and bluish varieties occasionally occur. Capsule 13 mm long and 6.3 mm wide, dark purple; seeds dull brown, 0.32 mm × 0.25 mm large, with prominent caruncle. So those features must be regarded as characterising typical, true *C. danfordiae* fide G. Maw.

Adil Güner (an editor) in The Illustrated Flora of Turkey (in preparation, available on internet as Web edition, last edit 8<sup>th</sup> January, 2022 see [here](#) ) significantly widens the concept of *Crocus danfordiae*. He accepts a separation of *C. brickellii* and *C. minutus* as distinct species, but all other acquisitions with small flowers and annulate corm tunics, throughout all Turkey, he considers only as an extremely variable single species - *C. danfordiae*. Although in most positions A. Güner's characteristics match with those given by G. Maw, there is one significant position in *Crocus* taxonomy, where A. Güner interprets a character more widely, and it is the presence of ribs in lateral channels. Whilst G. Maw clearly notes that *C. danfordiae* has 2 ribs in each lateral channel, according to A. Güner there could be any number from 0 to 2. For this reason, we made special attention to leaf morphology of *C. danfordiae sensu lato* samples grown in our collections.



48 and 49 *Crocus kurdistanicus* 18IRS-020.

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The most Eastern species which looks similar to *C. danfordiae* and it was regarded as its subspecies by authors is ***C. kurdistanicus***, raised by Rukšāns to species status. As the main feature separating it from typical *C. danfordiae* was the flower colour, characterised as bright yellow *versus* pale yellow in *C. danfordiae*. The problem was that in West of Turkey, along the road from Antalya to Altinyaka (an accession no. 14TUS-013) and on Ekizce Yaila (an accession no. JJVV-052) in the same region a tiny crocus with bright yellow flowers grows, up to the last regarded as *C. danfordiae sensu lato*. The original description was quite incomplete, so after the discovery of *C. kurdistanicus* in Iran by D. Zubov (an accession no. 18IRS-020) it was possible to prepare complete description of this species. Comparing the details of *C. kurdistanicus* morphology with G. Maw's description, we found that the main real feature to separate both species is hidden just in leaf morphology – lateral channels of *C. kurdistanicus* has only 1 rib, rarely there was observed rudimental 2<sup>nd</sup> rib (versus 2 ribs in *C. danfordiae* *fide* G. Maw), but in both similar bright yellow blooming samples from W of Antalya there are no ribs in lateral channels. Seeds of *C. kurdistanicus* are light pinkish brown *versus* dull brown according to G. Maw and our observations (not characterised by A. Güner). This confirms that *C. kurdistanicus* can be regarded as different species, even though it gives a good germination of seeds after controlled pollination with pollen of the bright yellow “*danfordiae*” sample from W of Antalya, because the distance between them is so long, that there was no necessity to develop reproductive incompatibility. Similarly for *C. autranii* Albov from Abkhazia (W Transcaucasus) and *C. gilanicus* B. Mathew from Iran which easily hybridize both ways and their progeny is fertile, too.



Far Left:  
50  
*Crocus  
brickellii*  
12TU-  
020.

Left:  
51  
*Crocus  
brickellii*  
yellow  
form.



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***Crocus brickellii*** was found by Rukšāns in 2012 on Belpinar Beli. It was another species which looked very similar to *C. danfordiae* but had very special feature, clearly separating it from its kins – the stigma in *C. brickellii* is at least level with tips of anthers but usually well overtops them, whilst in *C. danfordiae* it usually reaches no higher than the middle of the anthers, and occasionally can be positioned at almost base of anthers. Another feature differing from *C. danfordiae* fide G. Maw is the absence of ribs in lateral channels. Both, G. Maw and A. Güner, state that in *C. danfordiae* stigma is positioned at middle of anthers and according to G. Maw *C. danfordiae* lateral channels has 2 ribs. Later J. Rukšāns together with I. Sözen found it on yaila near top of Tuzla Tepe (Asas Dağı). A. Güner in The Illustrated Flora of Turkey mentions only the last locality where it was collected, also by Dr. Osman Erol from Istanbul University.



52 *Crocus minutus*, yellow HZ-88-38



53 *Crocus minutus* R2CV-038

***Crocus minutus*** was published by H. Kerndorff and E. Pasche (abbreviation HKEP) in 2011. It was recorded from 3 mountain ridges - Bey Dağları, Tahtalı Dağı, and Katrancık Dağı where it grows in open areas, light forests, scrub, together with *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Juniperus* L. sp., *Cistus laurifolius* L., *Verbascum* L., *Crocus flavus* subsp. *dissectus* T. Baytop & B. Mathew (correctly to be named *C. mouradii* Whitall –

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our note), *Ornithogalum* L., *Colchicum* L., and others. A. Güner in The Illustrated Flora of Turkey lists 3 localities but on the attached map are marked four sites (in green) from where it was observed.

The main feature separating it from *C. danfordiae* fide G. Maw is white stigma and leaves with lateral channels having no rib or rarely one. After that we checked our collections and found that we are growing 5 samples of *danfordiae*-like crocus with white stigmas: 3 of them were collected by us and 2 received from Gothenburg Botanical garden originally collected by J. Persson (in 1991) and H. Zetterlund (in 1988). Two samples grown by us matched well with the area of distribution given for *C. minutus* by HKEP and A. Güner, only the sample gathered by H. Zetterlund (HZ 88-38) had yellow base colour, not mentioned by authors, and due to close relationship with *C. danfordiae sensu lato* presence of such populations, was not very surprising. Much more we were surprised by presence of plants with orange stigmas in the same area which more resembled *C. danfordiae sensu lato*. A. Güner mentions *C. minutus* for Ekizce Yaila. Our team twice visited the vicinity of Ekizce Yaila and found only plants with very small deep yellow flowers having orange to reddish stigma growing together with *C. antalyensis* B. Mathew.

Three of our gatherings with white stigma were from region lying out of area designated for *C. minutus* – forming a close group positioned to south of Lake Beyşehir in Konya Province, morphologically turned out to be quite different from *C. minutus* having basically blue flower colour and leaves with 2 prominent ribs in each lateral channel. If not the distinctly white stigma, they more resembled *C. danfordiae* fide G. Maw. The plants of accession no. JP 91-13B used for holotype of a new species was sown up to F3 and all the seedlings kept specific flower features (including colouration pattern) and did not show any sign of hybridization. Considering those features and geographical position of those populations, we decided to publish it as a new species and to name it after our very long-time travel partner Jiri Bydzowsky from the Czech Republic.

The description of a new species was based on the cultivated plants from the following wild accessions:

*JP 91-13B* – Konya province, 34 km from Beyşehir to Ibradi, c. 1300 m elevation; leg. J. Persson. Sample received from Gothenburg Botanical garden.

*BATM-471* - Konya province, 25 km before Teke gec. on rd. Akseki – Beyşehir, at altitude 1340 m, 37°05' N 31°46' E; leg. J. Rukšāns 7<sup>th</sup> June, 2004.

*R2CV-047* – Konya province, near turn to Akseki from Huğlu, alt. 1395 m, 37.27'N, 31.39'E; leg. J. Rukšāns, 18<sup>th</sup> March, 2008.



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Map 3: Brown marks - *C. brickellii*, green and red - *C. minutus*, yellow - *C. bydzowskyanus*.

### ***Crocus bydzowskyanus* Rukšāns & Zubov *sp. nov.***

**Type:** Turkey, Konya Province, 34 km from Beyşehir to Ibradi, c. 1300 m elevation; (specimens no. JP 91-13B grown in Latvia in the garden of Jānis Rukšāns), fl. 02 Mar 2023, Rukšāns s.n.; holotype RIG III (Herbarium Latvicum BOT-16494).

**Habitat and distribution** – at present known from 3 gatherings in Konya Province to the south of the Lake Beyşehir where it grows on open places in sparse grass between dwarf shrubs on heavy clay ground, observed at 1300-1400 m elevation.

**Flowering time** – in wild observed in March, in cultivation February-March.

**Corm** – subglobose, something flattened, 11-15 mm in diameter.

**Tunic** – strong, coriaceous, without basal splits.

**Tunic neck** – 5-6 mm long, formed by triangular splits of main tunic.

**Basal rings** – usually 2, distinctly toothed with short, sometimes of irregular length tooth.

**Prophyll** – absent.

**Cataphylls** – 3-4, greyish white.

**Leaves** – 4-5-6, grey-green, minutely papillose on lamina edges, 1.5 – 2 mm wide and 15-23 cm long at maturity, at start of blooming ends over base of flower segments but during anthesis soon overtop flowers, mostly parallel edged, gradually tapering only in upper part,

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white stripe narrow – around 1/4 -1/5 of lamina width, lamina edges distinctly down and slightly inward turned, lateral channels open, with 2 ribs, keel edges nude or with very minute papillae on edges, widened at bottom with outward curved base.

**Perianth tube** – white, flushed greyish over white in upper part.

**Bract and bracteole** – almost equal, bracteole slightly smaller, silvery, almost reaching base of flower.

**Throat** – nude, lighter or darker yellow, on top with diffused white edge.

**Filaments** – 4-5-7 mm long, papillose, light yellow.

**Anthers** – 5-6-8 mm long, yellow with black tipped basal lobes, +/- arrow shaped with distinctly notched tip.

**Connective** – creamy.

**Style** – marble white, ends at middle of anthers, sometimes something higher, stigmatic branches diverged, 3-5-7 mm long.

**Flower segments** – variable in colour but always based on blue and with greyish or darker blue stippled outside of outer segments.

**Outer segments** – 18-21-27 mm long and 4-5.5-8 mm wide, in type gathering outside flushed blue over white, at base greyish, inside white with 3 blue stripes over yellow basal blotch, reaching tip of segment; in samples BATM-471 and R2CV-047 – outside light blue, stippled darker blue, at base greyish over pale yellow, inside light blue.

**Inner segments** – 16-19-22 mm long and (3)5-5.5-7 mm wide, in type gathering outside striped lilac over white, basal blotch greyish with white edge, inside lilac with darker veining; in samples BATM-471 and R2CV-047 outside and inside of same colour and same as on outer segments inside.

**Capsule** – up to 20 mm long and 8 mm wide, positioned up to 2 cm over ground level but usually rather lower; in basal third to half, light greenish buff, higher gradually turning lilac with prominent peak at top.

**Seeds** – dark brown, roundish to slightly elongated up to 3 mm long (proper seed slightly more than 2 mm long) and up to 2 mm wide with small but distinct ridge-like raphe and large prominent caruncle at end, testa distinctly but finely roughed, but not reticulated (checked by 40x hand lens).

**2n** = unknown

**Recognition** – similar to typical *C. danfordiae* fide G. Maw having leaves with two ribs in each lateral channel, but easy separable by its white stigma which in *C. danfordiae* is deep orange or even red.



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**Examined specimens** – Type: Turkey, Konya Province, 34 km from Beyşehir to Ibradi, c. 1300 m elevation; (specimens no. JP 91-13B grown in Latvia in the garden of Jānis Rukšāns), fl. 02 Mar 2023, *Rukšāns* s.n.; holotype RIG II! (Herbarium Latvicum BOT-16494).

**Etymology** – named after Czech gardener, former chief gardener of Pardubice Jiri Bydzowsky, who was often our travel partner and greatly helped in collecting our samples, preparing herbariums etc.



Figs. 55, 56, 57 *Crocus bydzowskyanus* JP 91-13B



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Figs.58, 59, 60 *Crocus bydzowskyanus* R2CV-047





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61 and 62 *Crocus bydzowskyanus* BATM-471

64 *Crocus bydzowskyanus*  
JP 91-13 leaf morphology.



65 *Crocus*  
*bydzowskyanus* JP 91-  
13 flower parts.

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66 *Crocus bydzowskyanus* pollination.



67 and 68 *Crocus bydzowskyanus* seedpods & seeds.





69 *Crocus bydzovskyanus* holotype herbarium.

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Starting our research from all samples of our collections at present labelled as **C. danfordiae** *sensu lato* we selected only those where the origin was known, and which had been collected by ourselves or got from reliable sources being collected by other serious botanists who understand importance of exact origin of a sample. In such a way we were left with 21 samples with exactly known sites of collection. All those were mapped using Google Earth soft. Of course, our collection did not represent all acquisitions mapped by A. Güner and represented a much smaller amount of data, but even then, some general lines were clearly expressed. All samples grown by us on map dispersed in two distinct, clearly bordered groups separated by so named “Anatolian diagonal” into East and West groups of species.

A similar division was observed also between species earlier regarded as belonging to Series *Biflori* *sensu* B. Mathew (Kerndorff H. & al., 2013). A similar grouping of crocuses regarded as *C. danfordiae* by A. Güner, can be observed also on map prepared by A. Güner. In our collections Northern populations of *C. danfordiae sensu lato*, are poorly presented – only by 2 samples - so they were not included in this research.

During 2021- 2023 we made careful morphological studies on all samples grown in our collections. Main attention was given just on important feature in crocus taxonomy – number of ribs or their absence in lateral channels.

Ten plants were observed from each accession and for research there were used only originally wild collected plants and not their generative progeny in cultivation. A single exception, where it was impossible to follow this rule, were the accessions received from Gothenburg Botanical garden (marked as JP, HZ or KPPZ), but we trust that those are perfectly documented although they can represent also plants of seed progeny. Samples with very approximate indication of localities were excluded from research (S of Tokat – received from Czech collector Eduard Hanslik; S of Guzele W of Seydişehir – received from nurseryman Norman Stevens and other similar ones).

This research confirmed our hypothesis that under common name of *C. danfordiae* hides at least two different species. The gatherings forming the **Eastern group**, represented in this research by samples from 8 different localities (from a few localities even 2-3 gatherings were made at the same site during different expeditions) without exception almost invariably had lateral channels with 2 ribs in each, only occasionally in some individual one of channels had 1 rib but another – 2 ribs. This perfectly matches description of typical *C. danfordiae* given by G. Maw and so they can be regarded as true species - *C. danfordiae fide* G. Maw.



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70 Collection of *Crocus danfordiae sensu lato*.

The following wild accessions of cultivated plants were taken into account when describing a new species:

*KPPZ-274* - Kuyuklu Dağ, SE from Kangal, leg. H. Zetterlund, 1990.

*KPPZ-292* - Sivas, 13 km from Gurun to Pinarbasi, leg. H. Zetterlund, 1990.

*RUDA-096* - Dokuzdolanbac gec. (on map Demirci gec.), alt. 1890 m., right side of road, stony, scree like slopes after first hill on both sides of small stream and on top of first hill (as *C. biflorus sensu lato*). Leg. J. Rukšāns, 27<sup>th</sup> May, 2003.

*LST-347* - Rd. Malatya – Kayseri, 24 km before Derende, shortly after turn to Elbistan, alt. 600 m, 38°22'N, 37°37'E, volcanic rock slopes. Leg. J. Rukšāns, 14<sup>th</sup> June, 2005.

*LST-365* - Ziyarettepesi Geçidi rd. Gurun – Kayseri, here and elsewhere further downstream, alt. 1925 m, 38°49'N 36°54'E, stony clay slopes, leg. J. Rukšāns 14<sup>th</sup> June, 2005 and *JRRK-089* – same locality, leg. J. Rukšāns, 6<sup>th</sup> June, 2009.

*BATM-391* - 22 km before Goksum, on very hard red clay, alt. 1505 m, 38°8'N 36°41'E, leg. J. Rukšāns, 5<sup>th</sup> June, 2004.

*BATM-402* - Kaan gec., on very stony clay, between rock splits, alt. 1580 m., 38°15'N 36°20'E, leg. J. Rukšāns, 5<sup>th</sup> June, 2004 and *RUDA-099* – same locality, leg. J. Rukšāns, 27<sup>th</sup> May, 2003; *JJV-024* – same locality, leg. J. Rukšāns, 6<sup>th</sup> March, 2010.

*JRRK-085* - Mazikiran gec., flat stony clay with sparse Artemisia vegetation, alt. 1800 m, 38°43'N 37°09'E, leg. J. Rukšāns, 6<sup>th</sup> June, 2009.



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71 *Crocus danfordiae* KPPZ-274A - Kuyuklu Dağ.



72 *C. danfordiae* KPPZ-292 – Sivas.



74 *Crocus danfordiae* RUDA-096 - Demirci gec.



73 *Crocus danfordiae* KPPZ-292 – Sivas.



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75 *Crocus danfordiae* LST-347 nr. Derende.



76 *C. danfordiae* LST-365 Ziyarettepesi gec.



77 *C. danfordiae* BATM-391 – near Goksum.



78 *Crocus danfordiae* BATM-402 - Kaan gec.

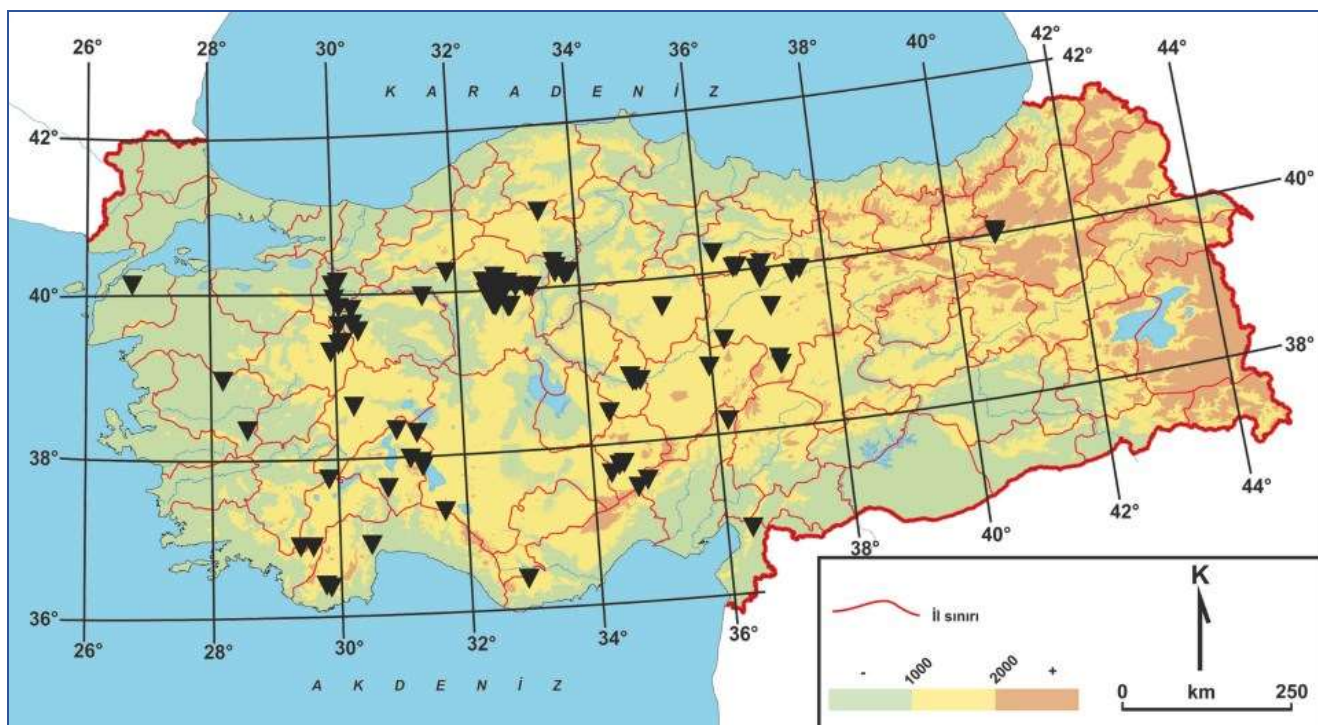


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79 *Crocus danfordiae* BATM-402 – Kaan gec.



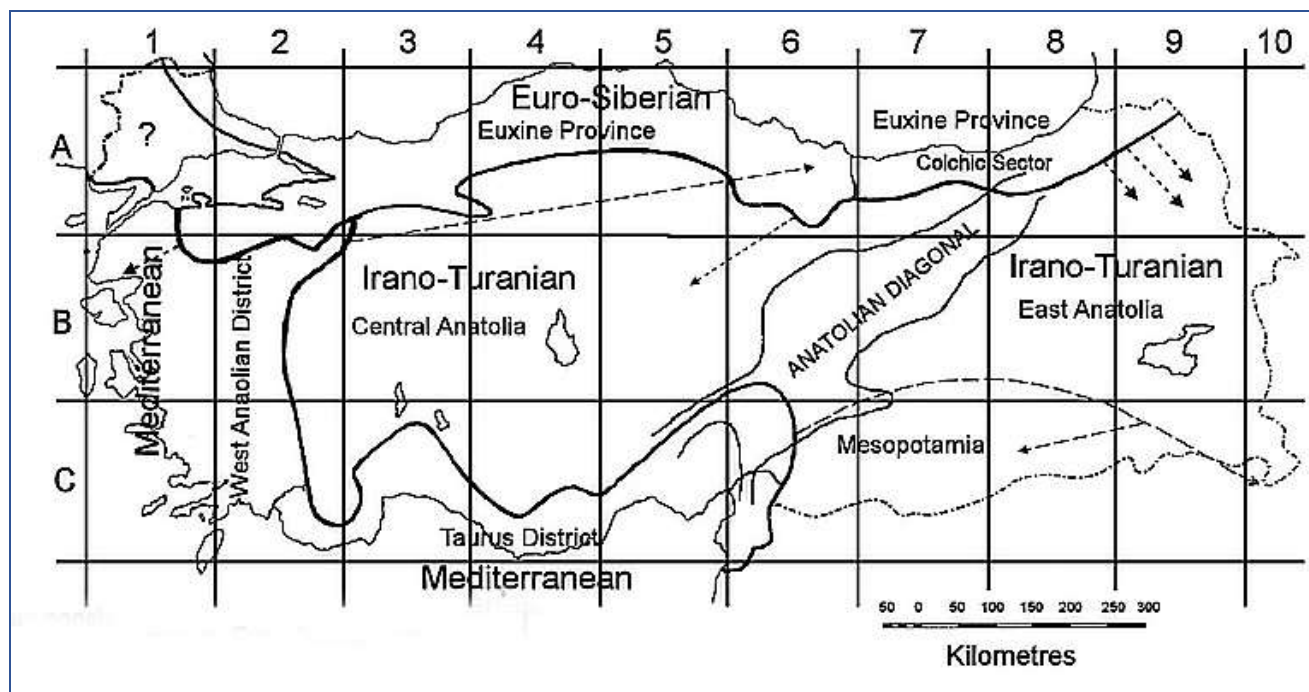
80 *C. danfordiae* JRRK-085 - Mazikiran gec.



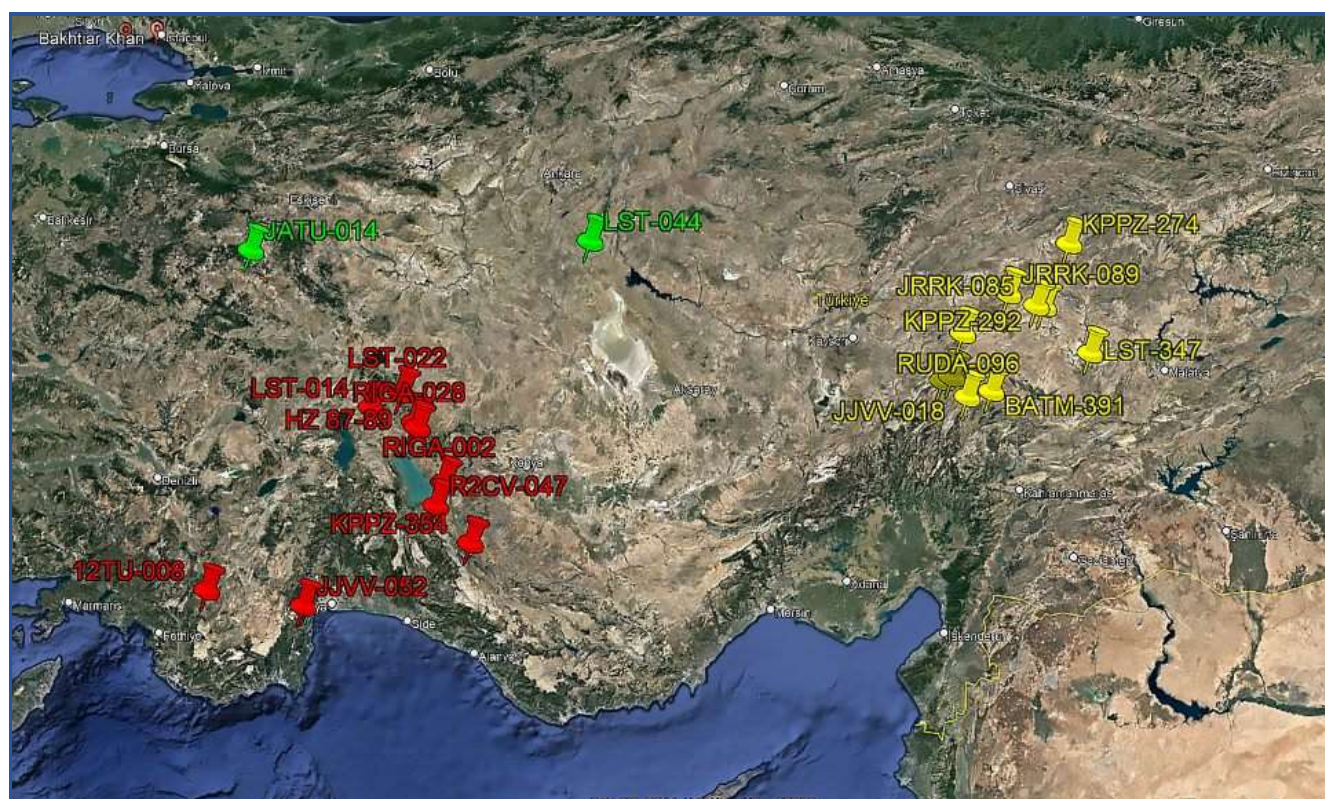
Map 4: A. Guner's © map of *Crocus danfordiae*.



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Map 5: Anatolian diagonal.



Map 6: *Crocus danfordiae* localities, *sensu lato*, observed by authors.

The **Western group** of species in this research is represented by 10(+2 from the north) samples from 9(-11) localities and almost invariably all samples had leaves with **lateral channels without ribs**, only rarely was some poorly developed, rudimental rib observed. The only exception was the group of 3 samples having in addition white stigma from the

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south of the Lake Beyşehir, Konya Province described here as *C. bydzowskyanus* sp. n. They all had lateral channels with 2 ribs and bluish based flower colour confirming their special status.

According to those results, we decided that crocuses, earlier considered as *Crocus danfordiae*, but growing to the west of Anatolian diagonal, deserve their own name. At the same time it should be noted that both samples collected more to the north and to the west from Anatolian diagonal (marked on attached map with green pins) also have no ribs in lateral channels, so they could belong to the same species, but as this region is too poorly represented in our collections, at this moment we excluded them from this research.

The following wild accessions of cultivated plants were taken into account when describing a new species:

*JP 87-89* – Beyşehir to Sarki Karagaç, 7 km before Sarki Karagaç, alt. 1300 m. leg. J. Persson, 1987, received from Gothenburg BG.

*KPPZ-354* - 85 km before Akseki from Beyşehir, alt. 1100–1200 m, leg. H. Zetterlund, 1990, received from Gothenburg BG.

*RIGA-002* - Near Uzumlu, between *Quercus* and *Juniperus*, alt. c. 1300 m. leg. J. Rukšāns, 25 May, 2002.

***RIGA-028*** - Fela vil., nr. Beyşehir Golu, disturbed habitat by woody plantations - alt. 1375 m, 38°01'N 31°29'E, leg. J. Rukšāns, 25 May, 2002. Used as type specimen.

*LST-014* - Between Eğirdir and Akşehir, W of Baktyar vil., serpentines, gentle slopes, on nude openings, alt. 1025 m, 38°11'N, 31°08'E, leg. J. Rukšāns, 1<sup>st</sup> June, 2005.

*LST-022* - Sultan Dağları, near Yellibel gec., steep slope, openings between *Quercus*, alt. Bekçiler

*JJV-052* - Ekizce yaila, in shrubs some 200 m from main road, up on the right side, alt. 1200 m, 36°43'N 30°26'E, leg. J. Rukšāns, 10<sup>th</sup> March, 2010 and *14TUS-011* – same locality, only a little higher at altitude 1342 m, together with *CC. lycius* and *antalyensis*, leg. J. Rukšāns, 21<sup>st</sup> March, 2014.

*12TU-008* - near Bekçiler on open slopes in small, sparse pine forest, alt. 1174 m., 36°49'N; 29°33'E, leg. J. Rukšāns, 1<sup>st</sup> March, 2012.

*14TUS-013B* – Sarichinardağ, along rd. to Antalya from Altinyaka in clearings of *Pinus* forest below powerlines and on roadside, alt. 1140 m., 36°35'N; 30°22'E, leg. J. Rukšāns, 21<sup>st</sup> March, 2014.



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*LST-044* - after Akşehir, near new motorway to Ankara, mountain steppe between *Artemisia* and *Stipa*, alt. 900 m, 39°11'N, 31°18'E, leg. J. Rukšāns, 2<sup>nd</sup> June, 2005.

*JATU-014* – Rd. from Kutahya to Gediz, near pass, alt. 1300 m, 39°17'N, 29°55'E, leg. J. Rukšāns, 12<sup>st</sup> March, 2007.



81 *Crocus cf. christianii* JP 87-89 - near Sarki Karagac.



82 *Crocus cf. christianii* KPPZ-354 - near Beyşehir.



83 *Crocus cf. christianii* RIGA-002  
– near Uzumlu.

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84 *Crocus cf. christianii* LST-014 W of Bahtyar.



85 *Crocus cf. christianii* LST-022 - Sultan Dağlari.



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86 a, 86 b *Crocus cf. christianii* JJVV-052 - Ekizce yaila.



87 *Crocus cf. christianii* 14TUS-011 - Ekizce yaila.



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88 *Crocus cf. christianii* 12TU-008 – near  
Bekçiler.



89 *Crocus cf. christianii* 14TUS-013B –  
Sarichinardağ.



90 *Crocus cf. christianii* LST-044  
- near Akşehir.



91 *Crocus cf. christianii* JATU-014 - Kutahya  
to Gediz.



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Accessions from N Turkey and to the west of Anatolian diagonal were not included in this paper.

Therefore, we decided to name a new species after a famous nurseryman working in Wales of United Kingdom and running “Rare Plant Nursery” and who supplied us with many rare and valuable plants and shared with us information about his trips and plant findings - Paul John Christian. As the type specimen it was selected the cultivated plants obtained from the accession no. RIGA-028 (from nr. Fela village, NW of Lake Beyşehir, Turkey).

***Crocus christianii*** Rukšāns & Zubov **sp. nov.**

**Type:** Turkey, Konya Province, Fela vil., nr. Beyşehir Gölu, disturbed habitat of forest plantations, at 1375 m elevation, 38°01'N 31°29'E; cult. (specimens no. RIGA-028 grown in Latvia in the garden of Jānis Rukšāns), fl. 22 Feb 2021, *Rukšāns* s.n.; holotype RIG III (Herbarium Latvicum BOT-16513).

**Habitat and distribution** – Konya Province, north part of Beyşehir Gölu, where it was found during our first trip to Turkey growing in disturbed habitat by woody plantations on formerly open meadow. It is very possible that this species is distributed in much wider area, morphologically very similar plants were found at 11 other localities, but without molecular & genetic analysis it is impossible to judge about their taxonomic status.

**Flowering time** – most likely March, type specimens were gathered with almost dry leaves at end of May.

**Corm** – slightly flattened globose, around 10-12 mm in diameter.

**Tunic** – hard with irregular few splits at base.

**Tunic neck** – 4-5mm long, formed by narrowly based triangular splits of main tunic.

**Basal rings** – narrow with uneven upper edge and sparsely irregularly spaced small triangular tooth.

**Prophyll** – absent.

**Cataphylls** – 4, slightly buff shaded whitish, darker at top.

**Leaves** – 3-4-6, dark green, smooth, up to 24 cm long and 1.5(-2) mm wide, gradually tapering to top, white stripe 1/5(-1/4) of lamina width, lamina and keel edges papillose, lamina edges down and inward turned, lateral channels narrow but open, without ribs, keel narrow with wide flat base.

**Perianth tube** – whitish, turning greenish grey shaded at top.

**Bract and bracteole** – transparent silvery, slightly striped lilac, bracteole much narrower and slightly shorter, sometimes even hidden inside tubular bract, ends 1-2 cm over ground level or around 2 cm below flower base.

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**Throat** – nude, indistinct yellow, only slightly darker than segments inside colour.

**Filaments** – 2-4-5 mm long, papillose, light yellow.

**Anthers** – (7)8 mm long, yellow with black basal lobes, parallelly edged, abruptly pointed or rounded at top.

**Connective** – light yellow.

**Style** – yellow, stigmatic branches diverged, 2-3.5-4 mm long, turning orange to red at top, stigma fringed, ends well below tips of anthers: sometimes only slightly over anther's base, rarely higher than middle of anthers, but never reach anther's tips.

**Flower segments** – pale yellow throughout, only outside greyish stippled. In other researched samples also white stippled grey or bluish on outside, but taxonomic status of those are not yet checked. In type specimen they are lanceolate, notched at tips.

**Outer segments** – 14-16.5-19 mm long and 3-3.5-5 mm wide, pale yellow, stippled greyish on outside, especially in middle part, inside pure pale yellow.

**Inner segments** – 12-15-18 mm long and 3-3.5-4 mm wide, pale yellow on both sides of same shade as outers segments outside.

**Capsule** – up to 20 mm long and 5-6 mm wide, positioned 2-3 cm over ground level, throughout violet, only at base lighter, with small peak at top.

**Seeds** – light brown, elongated, up to 4 mm long (proper seed 3 mm) and up to 2 mm wide, with prominent raphe and caruncle, testa finely roughed (checked by 40x hand lens).

**2n** = unknown

**Recognition** – easy separable from other related species by morphology of leaves which has lateral channels without ribs (rarely one poorly developed, rudimental rib observed) versus 2 ribs in *C. danfordiae* fide G. Maw, yellow orange to red stigma versus white stigma in *C. bydzowskyanus* and *C. minutus*.

**Examined specimens** – Type: Turkey, Konya Province, Fela vil., nr. Beyşehir Gölü, disturbed habitat of forest plantations, at 1375 m elevation, 38°01'N 31°29'E; cult. (specimens no. RIGA-028 grown in Latvia in the garden of Jānis Rukšāns), fl. 22 Feb 2021, *Rukšāns* s.n.; holotype RIG II! (Herbarium Latvicum BOT-16513).

**Etymology** – named after the famous nurseryman working in Wales, United Kingdom and running “Rare Plant Nursery”, who supplied us with many rare and valuable plants and shared with us information about his trips and plant findings - Paul John Christian.

Of course, the studies on crocus populations growing to the west from Anatolian diagonal must be continued and their identity to the type plants of *C. christianii* must be checked using modern molecular & genetic methods, sadly, not available for us, the independent researchers.



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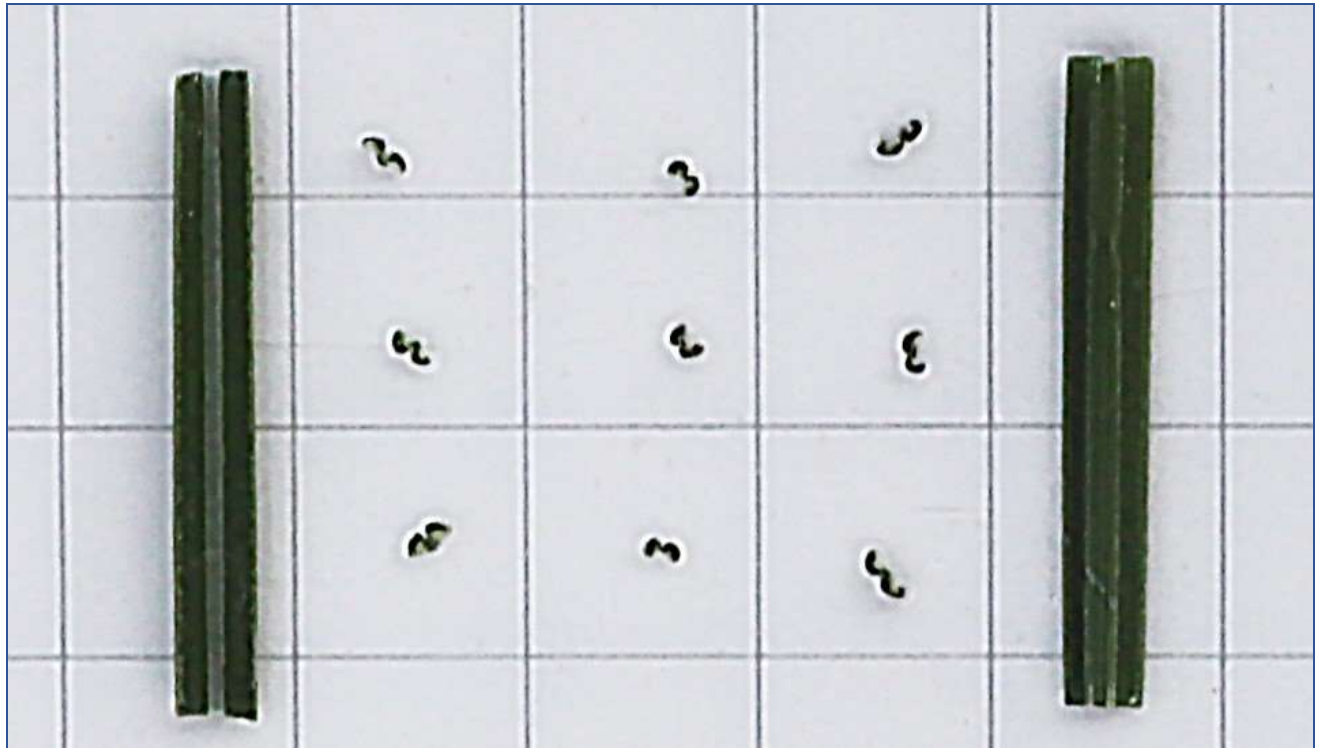


92 *Crocus christianii*  
RIGA-028 – used as type  
specimen.



93 *Crocus christianii* RIGA-028 - flower parts.

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94 *Crocus christianii* RIGA-028- leaf morphology.



95 and 96 *Crocus christianii* seedpods & seeds.





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97 *Crocus christianii* RIGA-028 - holotype.

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Figs. 98, 99, 100 *Crocus christianii*  
RIGA-028



## Acknowledgments

We express our thanks to our Iranian guide Sholeh Jalili Khiabani, who led our group in 2018 within northern and western Iran during which the long-searched for *Crocus kurdistanicus* was found, and to all our team partners during many trips in Greece and Turkey – Arnis Seisums (Latvia), Henrik Zetterlund and Gerben Tjerdsmas (both Sweden), Ibrahim Sözen (Turkey), Vaclav Jošt and Jiri Bydzowsky (both Czech

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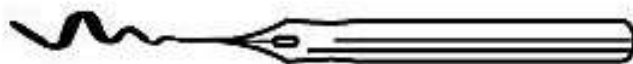
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## --- Helpful Hints ---

### **The use of soil blocks for seed sowing**

#### **- text and photos by Robert Barnard**

*[Ed.: Please note that while the author is American, the spellings and measurements are those of English usage and metric units. Moulds of different sizes are readily available online.]*

When I first started growing California native annuals, I either broadcast the seed on bare mineral soil hoping they would germinate, grow, and eventually bloom, or I would sow the seeds into traditional seed pans then transplant the seedlings to 6cm rose pots before setting the plants out in the garden. Considering my objectives, both methods bore unsatisfactory results: With direct seeding only the most robust species germinated and grew well. Many of the more interesting species did not germinate at all. In seed pans, germination was very successful; however, the percentage of plants lost during the initial transplanting process was unacceptably high. I needed to find a method where I could achieve consistent results with a wide range of species and drastically reduce transplant losses, especially with seeds involving hand pollinated hybrid crosses or seeds representing unique and potentially useful genetic mutations.



Soil Blockers – left to right – 1.5cm, 4cm and 5.25 cm sizes (½, 1½ and 2inch sizes)

Containerless soil blocks have been in use in commercial agriculture for many decades. Not only is the need for containers eliminated, but also the loss of plants due to transplant shock is almost completely eliminated. I was already successfully using soil blocks to produce



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vegetable transplants, so I reasoned that this method might be easily adapted for starting California native annuals and indeed, other plants.

My first attempts at using this system with California native annuals were extremely successful. The system worked well with a wide range of species and phased out any transplanting losses. Over the seasons I have been experimenting with this system to determine the range of species that adapt well to this seed propagation method.



Bottom view 4cm soil blocker

So far the results of these propagation experiments have been mixed: Many perennial species have responded favorably to this system; however, the system needs to be modified for species needing stratification/vernalization. I also found that alpine species that need very quick draining, free-flowing soil, and bulbous species are not well adapted to this system. In the former, the large size of the coarse materials contributes to a mixture that is too loose and does not hold together well. With the latter, the soil block is too shallow for the majority of bulbous species since they need a deep zone for their roots and bulb formation. I continue to experiment by combining facets of the soil blocking system with other methods of seed propagation to ascertain if the benefits of the soil blocking system can be incorporated into other seed propagation methods, increasing the range of species adaptable to some sort of modified soil blocking system.



Bottom view – 1.5cm soil blocker

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My method for making soil blocks is very simple. Having the proper soil mix is very important. The consistency of the soil mix needs to be such that the soil blocks will hold together but are not so dense that the blocks become rock hard. Water needs to penetrate the blocks easily and root growth needs to be encouraged by a proper degree of friability to the soil. I have used the following soil blocking mix with a great deal of success: 3 parts sifted milled sphagnum peat, 2 parts perlite, 1 part sifted garden soil, and 2 parts sifted compost. *[Ed.: leaf mould may be used as a replacement for peat.]* Our soil is a clay-loam. The small percentage of clay in our soil helps hold the soil blocks together. Those with very sandy soil might need to add a small amount of kaolinite or montmorillonite clay (these are both alumino-silicate clay minerals) to the mix to get the blocks to hold together properly. The use of high-quality compost in the blocking mix improves the effectiveness of mix immensely. We make huge amounts of compost each season. This biologically active compost is essential for healthy seed germination and the growth of the young plants. The addition of lime is sometimes recommended for soil block mixes. With California native annuals I have had much better success without adding lime. Many California native species prefer acid soils. Fertilizer is also recommended for most soil block mixes. I have had the best success adding alfalfa meal and bone meal/phosphate rock to the mix. I have been using alfalfa meal and phosphate rock as soil amendment for so long that I add the correct amount based on appearances. Recommended fertilizer amounts by volume of soil block mix can easily be found on the Internet.



5.25cm Soil Blocker with 1.5cm insert for accepting 1.5cm soil blocks

Once a soil block mix has been created, the proper amount of water needs to be added to the mix so that blocks will be formed correctly when pressed and ejected from the soil block moulds. Without experience this can be tricky: Enough water needs to be added to the mix so that the blocks are not too dry and fall apart when ejected from the moulds. With too much



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water added to the mix, the blocks will “melt” like wet snow on a sunny, warm day when ejected from the moulds. The consistency of a stiff concrete mix is generally perfect. By trial and error and with persistent determination consistent results will be achieved.

After the blocking mix is moistened to the proper consistency, it is time to press the moist blocking mix into the moulds.

For small-scale projects, I use 3 different moulds depending on the type and size of seeds I am sowing, or whether the seedlings will be shifted to larger blocks after germination. For very small seed, such as *Erythranthe bicolor*, I use a 20-block mould. Each block is 19 x 19 x 19 mm square.



*Erythranthe bicolor* seed germinating in 1.5cm soil blocks



This is a very floriferous selection of *Erythranthe bicolor*.



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For larger seed, such as *Lupinus succulentus*, I use a 5-block or 4-block mould. The 5-block mould produces five blocks 38 x 38 x 38 mm, and the 4-block mould creates four blocks 51 x 51 x 51 mm. The 5 block moulds help save space when seeding out many species, and the 4 block moulds have a square insert on the top of the block into which germinated seedlings in the 19 mm size blocks can be placed without any transplant shock. It is important when making soil blocks to press the blocking mix firmly into the moulds without air spaces or gaps in the mix. I use a fairly shallow and very firm plastic container for the molding process. Once the soil is in place in the mould, the newly formed soil blocks are easily ejected onto a plastic propagation nursery flat. Once the flat is full of soil blocks or enough blocks have been made, seeding out or shifting smaller blocks to larger blocks can start. I generally cover my newly planted seed with very finely sifted compost.

Newly created soil blocks can be a bit fragile. The newly sown seeds are best misted with a fine spray of water. The flow of water from a watering rose is generally too strong and coarse for seeds planted in newly created soil blocks and can erode the blocks creating a big mess. Once the blocks have set for a day or two, a coarser flow of water can be used to keep transplanted blocks moist. Fine seed will need misting, as needed, for a longer period of time, until the young plants become large enough to stand other watering methods. This can be several weeks depending on the type of seed and the time of year.



*Diplacus pictus* and *Clarkia gracilis* ssp. *traceyi* in 5.25 cm square soil blocks. Both were started in 1.5cm blocks before being transferred to the 5.25cm blocks.



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I place my newly planted soil blocks in a very simple cloche covered with greenhouse plastic. This cloche is large enough to accommodate a low bench to keep the flats well off the ground and protected from slugs, crawling insects, and flooding if the weather is wet. During dry, hot, sunny weather I remove the greenhouse plastic and cover the cloche with shade cloth. This protects the germinating seeds and young seedlings from excessive solar radiation. It also helps

prevent  
excessive  
and rapid  
drying of the  
seed blocks.

*Diplacus  
pictus*, in  
full bloom in  
April in the  
garden of  
Robert  
Barnard.



The use of soil blocks for sowing and growing on many California native annuals has been a very simple, efficient, and reliable system for me. The need for nursery liner pots is eliminated. More important, the loss of seedlings due to transplant shock has also been eliminated. Attention still needs to be given to other aspects of seed propagation. For example, the management of damping off fungus or the control of mold during cold wet weather still needs to be addressed regardless of the propagation method being used. Properly executed, the use of soil blocks can be a very efficient and effective method of seed propagation in a broad spectrum of horticultural circumstances and has proven to be ideal for the propagation of California Native Annuals.

R.B.