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Three New Species of *Crocus* (Liliiflorae, Iridaceae) from Turkey

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Abstract: Three new species of *Crocus* LINN. from western Turkey are described.

Zusammenfassung: Drei neue *Crocus*-Arten aus der westlichen Türkei werden beschrieben.

Key words: *Crocus fauseri, Crocus beydaglarensis, Crocus lydius,* SW and W-Turkey.

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Introduction

Approximately 76 Turkish *Crocus* populations were investigated systematically in the field by us since 1993 (KERNDORFF 1993, KERNDORFF & PASCHE 1994, 1997, 2003, 2004a, 2004b, 2006, 2011, PASCHE 1993). Amongst the studied populations from all over Turkey several new taxa are hidden which we plan to describe continuously from now on. Besides the comprehensive morphological data established by us, basis for this are the molecular results of all our investigated populations obtained from the biparental inherited ribosomal internal transcribed spacer (ITS: ITS1 + 5.8S rDNA + ITS2) region of nuclear ribosomal DNA (nrDNA). Results of this investigation were orally presented in February in Berlin (HARPKE et al. 2011) and are in preparation to be published in an article to be named "Phylogeny of Crocus (Iridaceae) based on two nuclear loci".

Description of new taxa

1. Crocus fauseri KERNDORFF & PASCHE, species nova

H o l o t y p u s : Turkey, Caria, Province Muğla, Kavak Dağları, 1000-1100 m, 11.3.2003, HKEP 0305 (Gatersleben, GAT 7455).

Cormus globosus, ca. 10 mm diam. Tunica coriacea, separata in segmenta lata cum annulis ad basem. Collum extensum ca. 5 mm; cataphylla 3, argentea-alba usque ad brunnea. Folia 3-4,91-7 (n=23), plerumque multo magis quam flores sub anthesi, atrovirida, 1–1,5 mm diam., glabra, rarissima ciliata; costis 1-2. Corolla fauce aurantiaca, glabra, perianthii tubus albidus usque ad violaceus. Perianthii segmenta exteriora 16-25-mm, plus minusve 22 mm longa, 5-10 mm, plus minusve 8 mm lata. Segmenta interiora 15-25 mm, plerumque 20 mm longa, 5-12 mm, plerumque 9 mm lata.

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Perianthii segmenta intus alba, violacea-brunnea ad basem, raro punctata. Segmenta exteriora ad paginem exteriorem plerumque cum nervatura grisea-caerulea. Prophyllum absens. Bractea et bracteola adsunt, argentea-alba vel brunneola. Filamenta 5-7 mm longa, plus minusve 5,8 mm (n=20), lutea vel aurantiaca, interdum brunneola, glabra; antherae 6-11 mm, plus minusve 9,3 mm (n=23) longae, nigrae; connectivum nigrum. Pollen luteus. Stylus saturate aurantiacus usque ad rubrum, divisus in partes tres, apex leviter tubaeformis; rami stigmatici ca. 3-7 mm, plus minusve 4,9 mm, scabridi usque ad papillosi. Stigma antheris plerumque brevioris usque ad aequalis (96%, n=23). Capsula plus minusve 1 cm longa, elliptica; semina saturate brunnea cum caruncula prominentia. Chromosomatorum somaticorum numerus 10.

Corm globose, about 10 mm in diameter. Tunics coriaceous splitting into rather broad stripes with rings at base; rings well developed with many small teeth of about 0,5-1 mm but up to 2 mm. Neck extension approximately 5 mm long. Cataphylls 3, silvery-white to brownish, sometimes the brown ones persistent. Leaves many, 3–4,91–7 (n=23) mostly much longer as flowers at anthesis, dark green, 1-1,5 mm in diameter, glabrous, very rarely ciliate, 1 or 2 ribs underneath on each side of the leaf. Width of white stripe approximately 1/3 of leaf diameter. Throat deep yellow, prominent, glabrous, perianth tube whitish to violet. Outer segments between 16 and 25 mm but usually 22 mm long, between 5 and 10 mm mostly 8 mm wide. Inner segments between 15 and 25 mm but usually 20 mm long and between 5 and 12 mm frequently 9 mm wide (mean of n=23 for all measurements). Inside all segments are white without markings (colour-plate 1, photographs 1-4). The outside of the outer segments are mostly finely veined greyish-blue, rarely speckled (colour-plate 1, flower variation of *Crocus fauseri)*. Outside colouring of the inner segments is mostly uniformly white without markings but having a dark violet-brownish spot towards the perianth tube. Prophyll absent. Bract and bracteole present, silvery-white or brownish (colour-plate 1, photograph 1). Filaments 5-7 mm on average 5,8 mm long (n=20), deep yellow to orange, sometimes brownish, glabrous; anthers 6-11 mm on average 9,3 mm long (n=23), black, connective black (colour-plate 1, photographs 1-4 and flower variations), pollen yellow. The styles are deep orange to red, divided into 3 branches which are very slightly trumpet-shaped towards the end; branches short 3-7 mm on average 4,9 mm long, scabrid to papillose. The styles are mostly shorter or equal as the stamens (96 %, n=23). Capsule approximately 1 cm long, elliptic, seeds dark brown with a prominent caruncle. Chromosome number 2n = 10.

The plant is named after Otto Fauser, an Australian crocus enthusiast. We are very grateful to him for his generous help and contribution of a comprehensive number of herbarium specimens to our work.

In its overall appearance the new species can habitually and morphologically be placed in the "circle" of *C. nubigena* and its allies (see cluster 2a in fig 1 and colour-plate 3 no. HKEP 0305 in Kerndorff & Pasche, 2006) although it is, as we know now, genetically quite distinct from those. The nearest taxon concerning this aspect is the one with the no. HKEP 0209 from Oyuklu Dağı (Muğla) but this one is quite different in appearance and has 2n=12 (compare KERNDORFF & PASCHE 2006).

The individuals of the investigated population have some remarkable combinations of features and are habitually rather uniform, compared to most of the other populations investigated, which are quite variable. The feathering of the outer segments is generally very fine, greyish-blue to slightly violet, mostly covering the whole segment, the three central stripes are generally not pronounced or clearly separated (colour-plate 1, flower variation of *Crocus fauseri*). sometimes the outer segments are rarely speckled like in *C. biflorus* ssp. *punctatus* Mathew. Most significant are the long completely black connectives and anthers, which are arrow-shaped but thickened and rounded at the top. In some individuals they are significantly tinged yellow at the two lower ends (colour-plate 1, figure 7 of flower variations). The whole appearance of filaments, anthers and styles in the flower reminds one a bit of *C. hittiticus* T. BAYTOP & B. MATHEW. Remarkable is also the high median leaf-number of 5 with a range between 3-7 as well as the deep green glossy surface of the leaves.

Distribution and habitat: Turkey, Caria, Muğla Province, very local, in open pine forests, together with *Pinus nigra* ssp. *pallasiana, Quercus coccifera, Rubus, Juniperus, Euphorbia, Draba,* and others. *Crocus fauseri* grows apparently only on calcareous formations and until now is only known to exist in the Kavak mountains SE of Milas.

2. *Crocus beydaglarensis* KERNDORFF & PASCHE, species nova

Holotypus: Turkey, Lycia, Antalya Province, SW Bey Dağları, 1000-1200 m, 20.03.1997, HKEP 9719 (Gatersleben, GAT 7388).

Cormus globosus, ca. 10 mm diam., Tunica plus minusve coriacea, in segmentas numerosas fissa, cum annulis ad basem. Collum plus minusve 5 mm, setaceum. Cataphyllae 3-4, argenteae-albae, brunneolescens. Foliae 3-7, plus minusve 4,4, non attingentes flores ad florationem, 1-2 mm latae, glabrae. Faux saturate flava, glabra. Tubus violaceus perianthii ad apicem, ad basem albidus. Segmenta exteriora 20-38 mm, plus minusve 29 mm longa, 7-13 mm, plerumque 10 mm lata. Segmenta interiora 18-36 mm, plus minusve 27 mm longa, 6-12 mm plerumque 9,3 mm lata. Ad paginam interiorem segmenta alba sunt, vel pallida caerulea sine macula. Segmenta 3-exteriora, pleramque dilute striata. Prophyllus absens. Bractea et bracteola argenteo-alba, aetate brunneolescens. Filamenta 5-8 mm, plus minusve 6,7 mm longa, lutea, glabra ad basem; antherae luteae,

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sagittatae, 8-16 mm, plus minusve 11,4 mm longae, cum connectivo sine colore. Pollen luteus. Stylus divisus in ramos tres, aurantiacus usque ad rubrum, apex leviter crispus, rami 4-7 mm, plerumque 5,4 mm longi, glabri. Stigma antheris plerumque longioris usque ad aequalis (86%). Capsula non visa. Chromosomatorum somaticorum numerous 8.

Corm globose, about 10 mm in diameter. Tunics coriaceous, the inner layer softer, splitting longitudinally into more or less broad stripes, with rings at base; rings without significant teeth but smooth edges. Neck short, about 5 mm long, bristly. Cataphylls 3-4, silvery-white, turning brownish with age. Leaves shorter than flowers at anthesis, 3-7 but in average 4,4 green, 1-2 mm in diameter, glabrous, 2 ribs or very rarely one rib underneath of each side of the blade. White stripe less than 1/3 of leaf diameter. Throat deep yellow (colour-plate 2, photographs 1-4), glabrous. Perianth tube violet near the apex, further down whitish. Outer segments between 20 and 38 mm but usually 29 mm long, between 7 and 13 mm, mostly 10 mm wide. Inner segments between 18 and 36 mm but usually 27 mm long and between 6 and 12 mm frequently 9,3 mm wide. Inside all segments are uniformly white or lightly blue without markings (colour-plate 2, photographs 3-4), outside of outer segments mostly faintly striped (colour-plate 2, photographs 1-2). Prophyll absent. Bract and bracteole present, silvery-white, with age brownish. Filaments 5-8 mm, on average 6,7 mm long, yellow (colour-plate 2, photograph 4, flower variations 1-4), glabrous at base; anthers yellow, arrow-shaped with indistinct peaks at the lower end (colour-plate 2, flower variations), 8-16 mm on average 11,4 mm long, connective colourless. Pollen yellow. The styles are orange to red, divided into 3 branches which are slightly extended at the apex; branches 4-7 mm but usually 5,4 mm long, glabrous. The styles are mostly longer or equal (86%) compared to the stamens. Capsule and seeds not seen. Chromosome number 2n = 8.

The crocus is named after its occurrence in the Lycian Bey Dağları. The white or slightly blue colour of the comparatively large flowers with faint bluish-grey stripes and speckles in all kind of combinations on the outside of the outer segments makes it in the overall appearance a rather pale but distinct member of the morphological cluster 1a in figure 1 in Kerndorff & Pasche, 2006, in which also *C. atrospermus* (HKEP 9377) and populations HKEP 9701, 0124, 0104, and 0112 are placed. The genetic analysis of this crocus confirms only partly the morphological grouping. Furthermore, we could find identical ITS sequences for the populations HKEP 9701, 9804 (2n=10), 0009 (2n=10), 0124 (2n=12), 0126 (2n=10), and 1001 and a very close one for HKEP 9377 (2n=10). This is surprising as all of them are morphologically and habitually distinct. However, a reason for this could be, that all populations except HKEP 0009 are distributed in the mountains of Lycia and populations had temporarily connections. These rather complex findings deserve further detailed analyses which will be carried out when the molecular results of all 76 investigated populations are integrated in the results of the entire genus.

Distribution and habitat: Turkey, Lycia, Antalya Province, SW Bey Dağları, 1000-1200 m, 20.03.1997, HKEP 9719 (Gatersleben, GAT 7388). So far it is known only from the type locality in the south-western Bey dağları, in open areas, light forests, scrub, together with *Crocus baytopiorum, Cyclamen alpinum, Quercus coccifera, Berberis, Veronica, Euphorbia, Colchicum, Scilla, Juniperus, Crataegus.*

3. *Crocus lydius* KERNDORFF & PASCHE, species nova

Holotypus: Turkey, Lydia, Manisa Province, Göldağ, 900-1100 m, 20.03.2006, HKEP 0606 (Gatersleben, GAT 7384).

Cormus globosus, ca. 10 mm diam.. Tunica coriacea, in segmentas numerosas fissa, cum annulis ad basem. Collum plus minusve 5 mm. setaceum Cataphyllae 3, argenteae usque ad brunneolae, membranaceae. Folia 2-2,3-3 (n=36), non attingentes florem ad florationem, atrovirida, subulata, 1,5-2,5 mm diam., subter cum costis multis (3-4,5-6, n=6), glabra. Faux flava, glabra, interdum violacea ad faucem profundum. Perianthii tubus caeruleo-violaceus ad apicem, albidus ad basem. Segmenta exteriora 14-25 mm, plerumque 18 mm longa, 5-12 mm, plerumque 7 mm lata. Segmenta interiora 13-25 mm, plerumque 17 mm longa, 5-13 mm, plerumque 7 mm lata. Ad paginam interiorem segmenta albida-caerulea cum macula pallida. Pagina exteriora segmentorum exteriorum plerumque caerulea, interdum cum linea saturate caerulea; pagina exteriora segmentorum interiorum pallide caerulea sine macula, sed cum macula grisea ad basem. Prophyllum abest. Bractea et bracteola argentea-alba, aetate brunneolescens. Filmenta 3-8 mm, plus minusve 5,6 mm (n=36) longa, albida usque ad lutea, glabra; antherae 5-10 mm, plus minusve 6,9 mm longae (n=36), luteae vel griseae, raro nigrae; connectivum incoloratum. Pollen flavum. Stylus aurantiacus, divisus in ramos tres, apex leviter tubaeformis; rami stigmatici 3-7 mm, plus minusve 5,1 mm longa. Stylus plerumque longi aequali antherarum vel longiorus (78%, n=36). Fructus non visi. Numerus chromosomatorum somaticorum 10.

Corm globose, about 10 mm in diameter. Tunics coriaceous splitting into segments with rings at base; rings with very long pointed teeth. Neck bristly, extended up to 5 mm. Cataphylls 3, silvery to brownish, skinny. Leaves 2–2,3–3 (n=36) shorter as flowers at anthesis, dark green, subulate, 1,5-2,5 mm in diameter, glabrous, many (3–4,5–6, n=6) ribs underneath. Width of white stripe smaller than to approximately 1/3 of leaf diameter. Throat yellow, glabrous, sometimes violet at the bottom of the throat. Perianth tube bluish-violet near apex, whitish below. Outer segments between 14 and 25 mm but usually 18 mm long, between 5 and 12 mm

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mostly 7 mm wide. Inner segments between 13 and 25 mm but usually 17 mm long and between 5 and 13 mm frequently 7 mm wide. Inside all segments are whitish-blue sometimes with faint markings shining through from the outside (colour-plate 3, photograph 1). Outside of outer segments usually uniformly blue, if striped, then in darker blue, not violet (colour-plate 3, photograph 3-4), outside of inner segments light blue without markings but sometimes with a greyish spot towards the perianth tube (colour-plate 3, flower variations 4,5,8). Prophyll absent. Bract and bracteole present, silvery-white, turning to brownish with age. Filaments 3-8 mm on average 5,6 mm long (n=036), whitish to yellow (photograph 1a), glabrous; anthers 5-10 mm on average 6,9 mm long (n=36), yellow, greyish or sometimes black, connective colourless to yellow or rarely blackish. Pollen yellow. The styles are orange, divided into 3 branches which are very slightly trumpet-shaped towards the end; branches 3–7 mm on average 5,1 mm long (photograph 1a). The styles are mostly equal or longer as the stamens (78%, n=36). Capsule and seeds not seen. Chromosome number 2n = 10.

Distribution and habitat: Turkey, Lydia, Manisa Province, Göldağ, 900-1100 m. The crocus is named after its occurrence in Lydia. So far it is known to us from three localities in the Göldağ mountains. It is -according to its ITS sequences- closely related to *C. ionopharynx* (HKEP 0306, colour plate 3 in KERNDORFF & PASCHE, 2006) having also the same chromosome no. of 2n=10. On the other hand it is habitually, morphologically and geographically quite separate from this one. Furthermore, it is also - according to its ITS sequence - closely related to *C. nubigena* from Balikesir province (to be published in part 5 of "*Crocus biflorus* in Anatolia"), but this one has a chromosome no. of 2n=12. However, both crocuses are geographically, habitually and morphologically well separated.

Crocus lydius is a remarkably distinct crocus. The teeth surrounding the rings of the corm tunic are unusually long and pointed. Normally it has only two subulate leaves which have an unusual high number of up to six ribs on each side of the grooves underneath. The colour of the segments is of a clear blue with an evenly blue feathering on the outside of the outer segments. It occurs apparently only on non-calcareous soils above magmatic and metamorphic rocks in open oak forests and *Cistus* scrub together with *Juniperus, Ornithogalum.*

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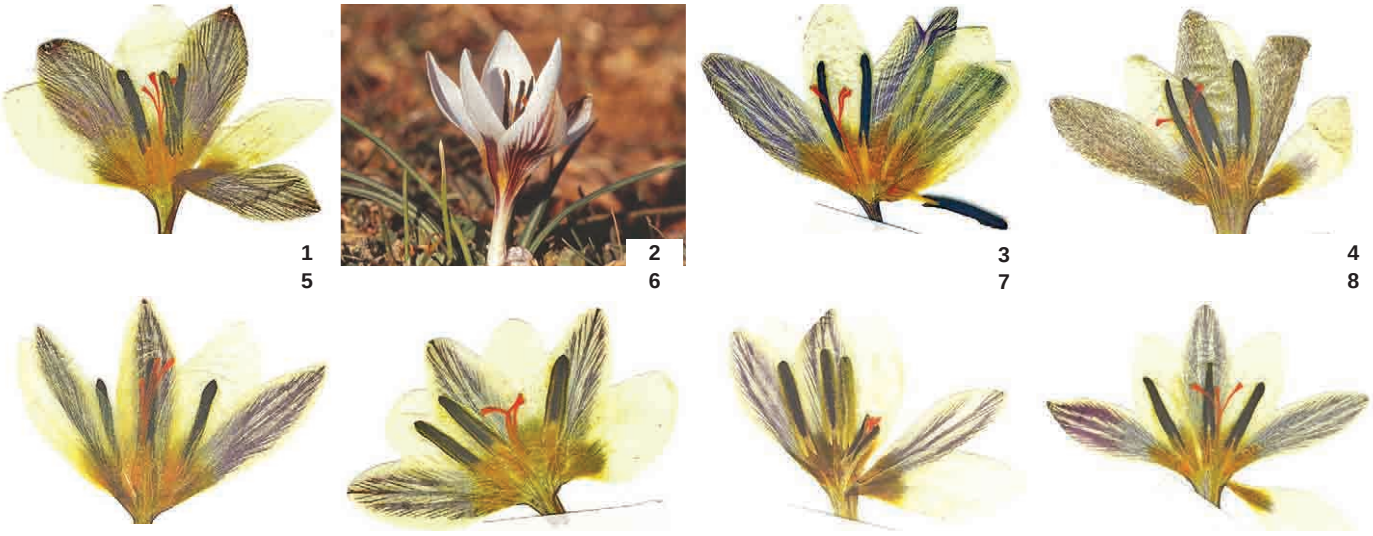
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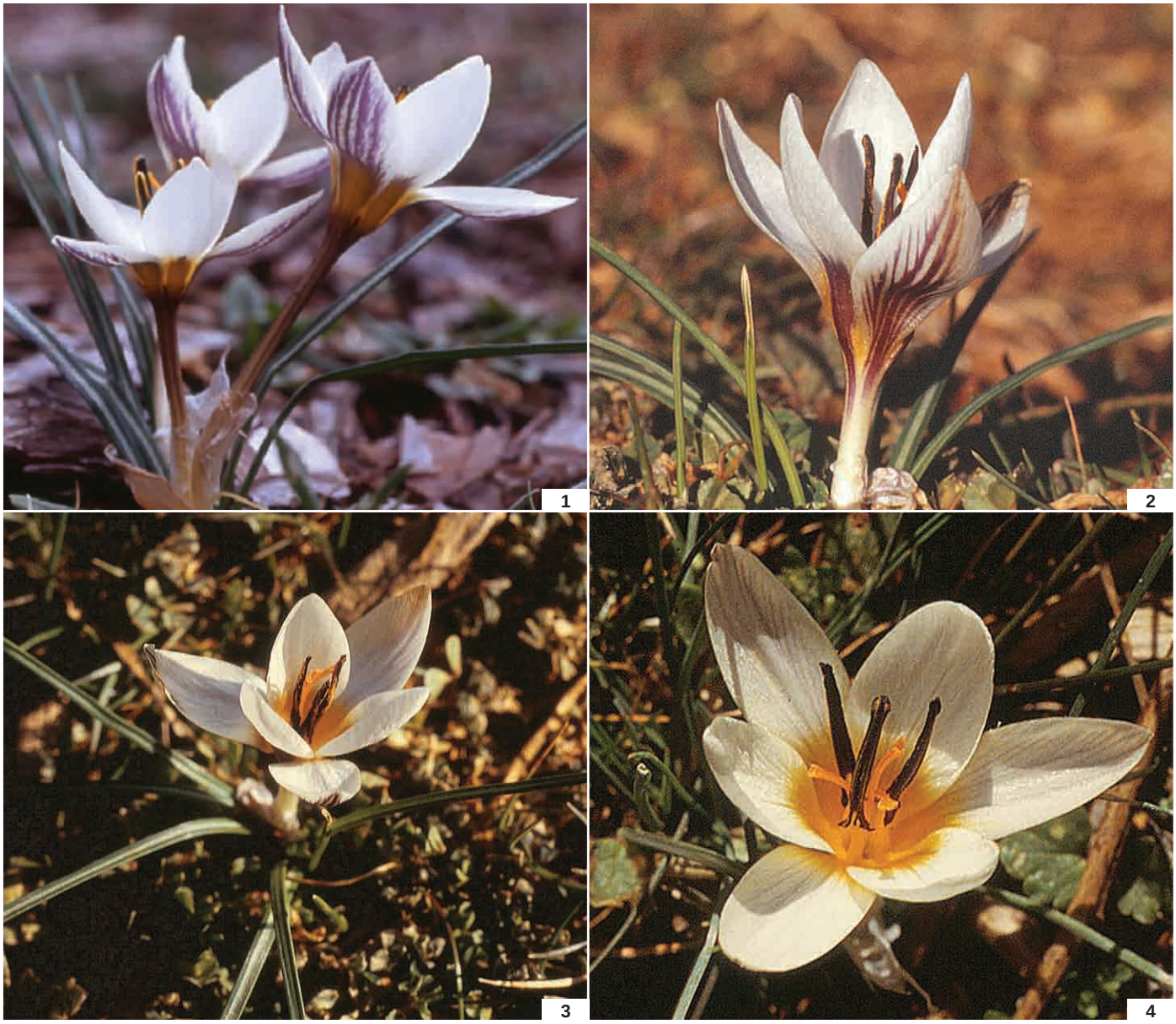
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Colour plate 1: Flower variation of ***Crocus*** *fauseri*.

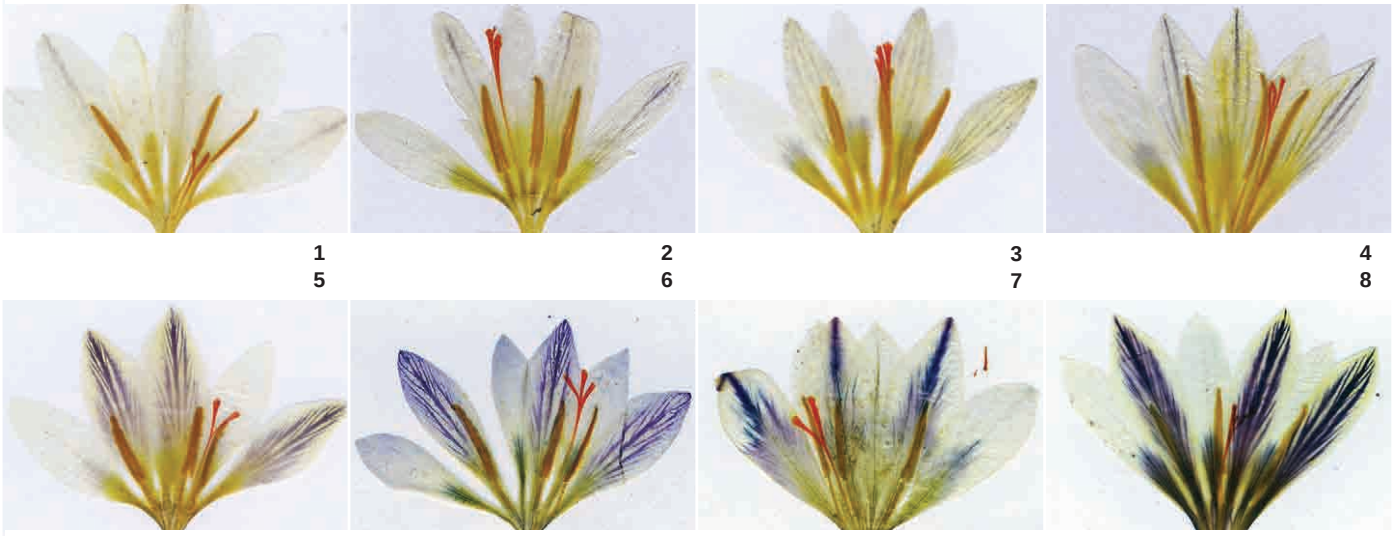


Colour plate 1: Flower variation of ***Crocus*** *fauseri*.



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Colour plate 2: Flower variation of ***Crocus*** *beydaglarensis*.



Colour plate 2: Flower variation of ***Crocus*** *beydaglarensis*.



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Colour plate 3: Flower variation of ***Crocus*** *lydius*.



Colour plate 3: Flower variation of ***Crocus*** *lydius*.



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