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

H. KERNDORFF*, E. PASCHE, D. HARPKE & F. R. BLATTNER

Abstract: Seven new species of *Crocus* L. from southern, south-western, western, and north-western Turkey are described.

Zusammenfassung: Sieben neue *Crocus*-Arten aus der südlichen, südwestlichen, westlichen und nordwestlichen Türkei werden beschrieben.

Key words: *Crocus mersinensis* (HKEP 0104), *Crocus taseliensis* (HKEP 0512b), *Crocus babadagensis* (HKEP 9708), *Crocus simavensis* (HKEP 0911), *Crocus mysius* (HKEP 0711), *Crocus bifloriformis* (HKEP 0602), *Crocus adamioides* (HKEP 0904).

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Introduction

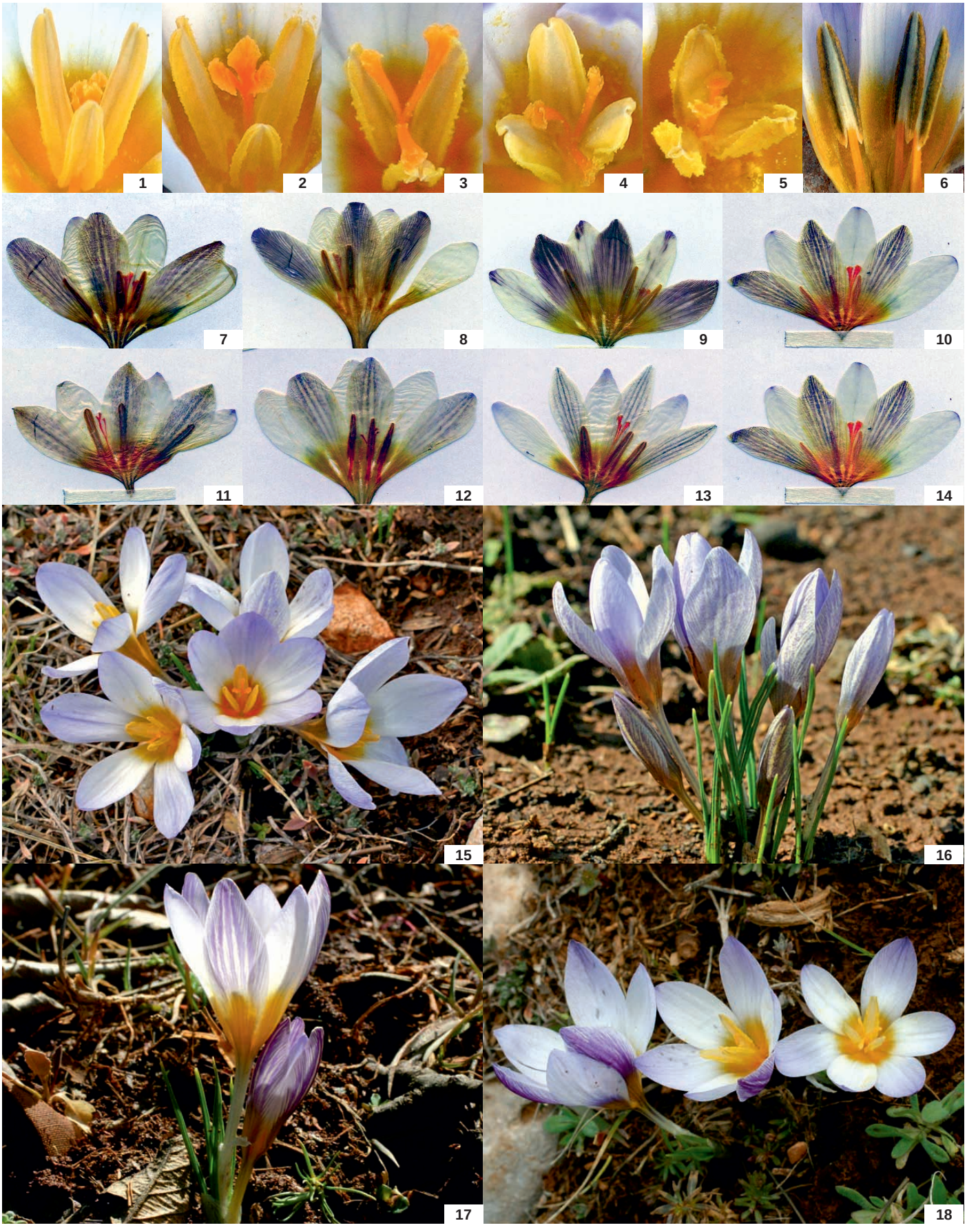
Fifteen years of extensive field-studies in Turkish crocuses combined with recent phylogenetic analyses of all of our approximately 76 in detail assessed populations using cpDNA, the biparental inherited ribosomal internal transcribed spacer region (ITS: ITS1 + 5.8S rDNA + ITS2) of nuclear ribosomal DNA (nrDNA) (HARPKE et al., 2011) and a single-copy gene *pCOSAt103* (HARPKE et al., 2012) brought several new taxa to our knowledge (KERNDORFF, 1993, KERNDORFF & PASCHE, 1994, 1997, 2003, 2004a, 2004b, 2006, 2011, PASCHE, 1993). In this article we consider new species of southern, south-western, western und north-western parts of Turkey. The new taxa we found in eastern Turkey will be published in part four of our series "*Crocus biflorus* in Anatolia".

Description of new taxa

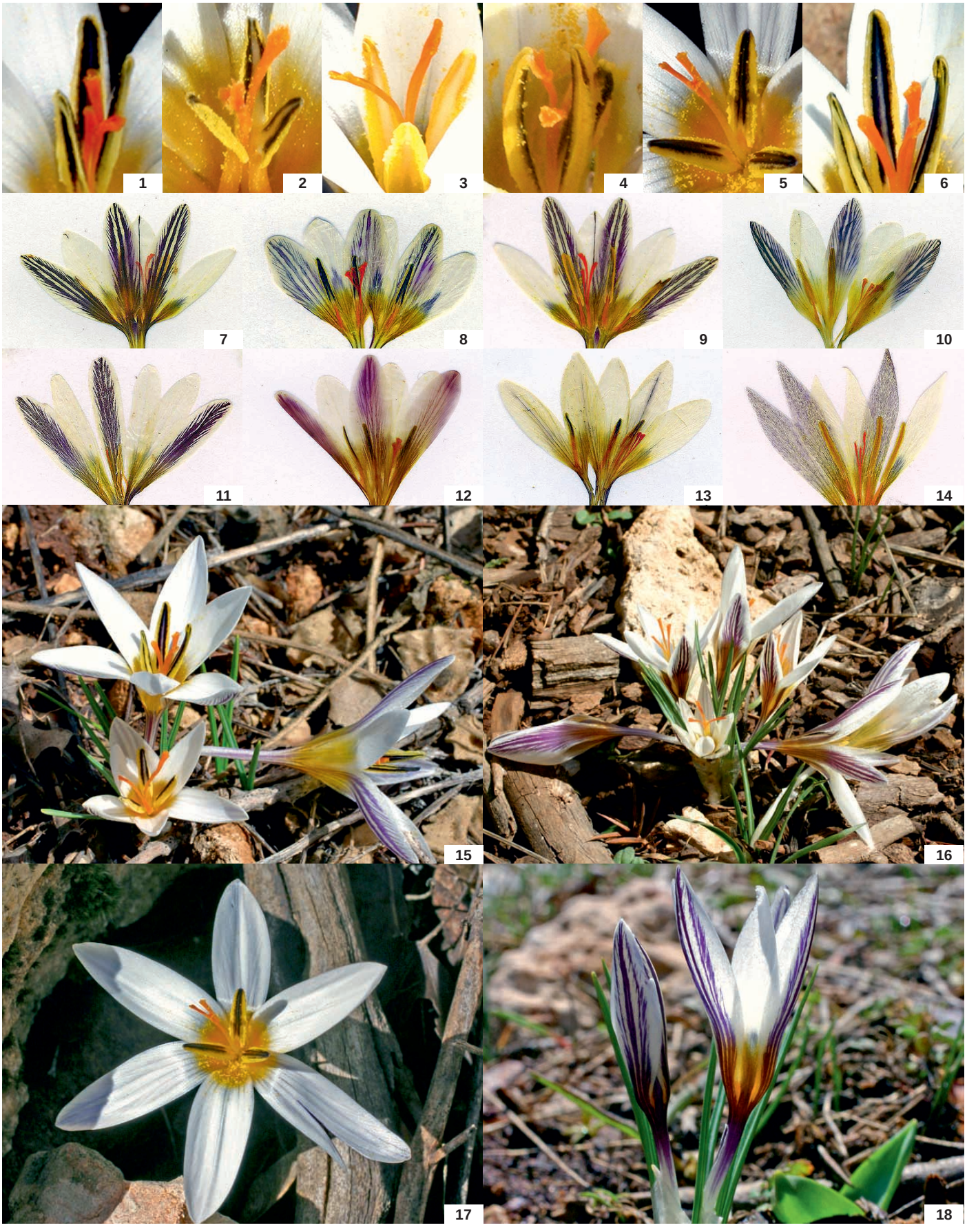
1. *Crocus mersinensis* KERNDORFF & PASCHE, species nova

H o l o t y p u s: Turkey, Cilician Taurus, Içel Province, Pusatlı Dağı, 1300-1400 m, 5.3.2001, HKEP 0104 (Gatersleben, GAT 7462).

Cormus globosus, ca. 10 mm diameter. Tunica coriacea, separata in segmentis latis cum annulis distinctis ad basem; apice in collum 5-10 mm longum producta. Cataphyllae 3-4, luteolae usque ad albas. Folia 2-4,2-6, 1,5-2 mm diam., bene evoluta ad florationem. Corolla fauce flava, glabra, perianthii tubus albus, striatus violaceo-brunneolus ad apicem. Perianthii segmenta exteriora 20-30-37 mm (n = 33) longa, 6-11-14 mm (n = 33) lata. Segmenta interiora 20-29-35 mm (n = 36) longa, 7-9,9-12 mm (n = 36) lata, ad paginam interiorem albida usque ad pallide



Colour plate 1: *Crocus mersinensis* (HKEP 0104), scaled flower parameters, 1-6, flower variations, 7-14, type locality photographs, 15-18.



Colour plate 2: *Crocus taseliensis* (HKEP 0512b), scaled flower parameters, 1-6, flower variations, 7-14, type locality photographs, 15-18.

albo-caerulea, caerulea vel lilacina. Segmenta exterirora extus subtiliter fasciata vel pinnata, vel pinnata pallide coeruleo-violacea, interdum pagina penita maculata; segmenta interiora extus albo-caerulea, plus minusve brunneola ad basem. Prophyllum absens. Bractea et bracteola argentea. Filamenta lutea usque ad aurantiaca, 3-4,7-6 mm (n = 20) longa, antherae 7-9,9-14 mm longae, luteae raro griseae, sagittatae, lobis basalibus breve. Antherarum connectivum prominens, latum, album usque ad pallide luteum. Rami stigmatici 4-**5,5**-8 mm longi (n = 23). Stylus divisus in partes tres, rami stigmatici lutei usque ad aurantiacum, apicem versus tubaeformes. Fructus non visi. Chromosomatorum somaticorum numerus 12.

Corm spherical, about 1 cm in diameter, tunics coriaceous, the inner ones softer, neck conspicuous, 5-10 mm long, bristly; splits of tunics only into broad segments, rings well developed, basic ones more or less saw-toothed (<<0.5 mm), no significant teeth on upper ones. Cataphylls 3-4, white to yellowish. Leaves 2-**4,2**-6, green, 1,5-2 mm in diameter, glabrous, white stripe smaller to max. 1/3 of leaf-diameter, two ribs underneath, rarely one of each side of the blade. Leaves well developed at anthesis but mostly shorter than flowers. Throat yellow, without hair. Perianth tube white, near the apex striped violet-brownish. Outer segments between 20 and 37 mm but usually 30 mm long (n = 33), between 6 and 14 mm but usually 11 mm wide (n = 33). Inner segments between 20 and 35 mm but usually 29 mm long, between 7 and 12 mm but usually 9,9 mm wide (n = 36). Inside all segments are evenly whitish to light blue or lilac, only striping of outside is shining through. Outer segments finely striped or feathered bluish-violet, sometimes speckled all over the segment, lines only pointed faintly by speckles. Inner segments plain whitish-blue, rarely with indistinct markings, towards perianth tube more or less brownish, often the yellow of throat shining through. Prophyll absent. Bract and bracteole present, silvery, not conspicuous. Length of filaments 3-**4,7**-6 mm (n = 20), yellow to orange-yellow, no hair. Anthers 7-**9,9**-14 mm long, yellow, very rarely greyish, broadly arrow-shaped with round tips and short lower ends. Connective prominent, broad, white to yellowish, pollen yellow. Style divided into 3 branches, mostly yellow to orange, trumpet-shaped at the upper end, branches 4-**5,5**-8 mm long (n = 23). Style length according to stamen is 72% longer to equal, and 28% shorter (n = 36). Capsule and seeds not seen. Chromosome number (2n = 12).

Crocus mersinensis is a rather strange taxon concerning the results of the ITS-DNA analysis. It is closely allied to *C. chrysanthus* populations found in the coastal mountains of the Isaurian Taurus, with 1 base-pair (bp) difference to HKEP 1110 and 2 bp difference to HKEP 1116 (both in Gatersleben). From its overall appearance it certainly belongs to a taxon group around *C. isauricus.* Remarkable are the large flowers with segments of 3 cm in average but up to 3,7 cm as a maximum, two ribs in the grooves of the leaves underneath and anthers which are in average more than double as long as filaments. There is a fine feathering or faint striping of bluish-violet on the outside of the outer segments, but never with strongly pronounced lines.

Distribution and habitat: *C. mersinensis* is until now only known from the type locality in the Pusatlı Dağı in the Cilician Taurus, Içel Province, Turkey. The plant grows in rocky and grassy areas and light woods, only on limestone among *Juniperus oxycedrus*, together with *Colchicum szovitsii*, *Verbascum*, *Marrubium*, thistles, grasses etc.

2. *Crocus taseliensis* Kerndorff & Pasche, species nova

Holotypus: Turkey, Isauria, Içel Province, Taşeli Yaylası 900-1100 m, 20.03.2006, HKEP 0512b (Gatersleben, GAT 7742).

Cormus globosus, ca. 10-15 mm diam. Tunica exteriora coriacea, interiora mollior, separata ad basem in paucis segmentis latis (2-10 mm), annulis bene evolutis, plus minusve serratis ad basem (<<0,5 mm) nec dentibus significatis annulorum superiorum. Cataphyllae argenteae-albae. Folia 3-5,7-8, atrovirida, glabra, 1-1,5 mm lata; folia nervis utroque costae latere 2, raro 3. Faux lutea usque ad aurantiaca, glabra. Segmenta interiora alba, interdum venosa griseo-caerulea. Segmenta exteriora alba, interdum venosa griseo-caerulea. Segmenta exteriora 21-26-34 mm (n = 35) longa, 5-7,9-10 mm (n = 35) lata. Segmenta 3 exteriora extus striata vel pinnata violacea, brunneola ad basem. Segmenta interiora 5-8,2-11 mm (n = 35) lata, extus alba usque ad pallide lilacina, interdum fuscans versus basem. Prophyllum absens. Bractea et bracteola argentea-alba. Filamenta 3-4,5-6 mm longa, saturate lutea, glabra, antherae 5-9,8-12 mm longae, 79% nigricae, 21% luteae (n = 34), cum connectivo albo, interdum caeruleo, nigro vel griseo, apprime versus apicem; pollen flavum. Stylus divisus in partes tres, praecipue aurantiacus. Rami stigmatici 4-**6,3**-8 mm. Capsula non visa. Chromosomatorum somaticorum numerus 8.

Corm spherical, 1-1,5 cm in diameter. Tunics coriaceous, the inner ones softer, splits at base few mainly into broad segments (2-10 mm) but into many small segments (0,5-1,5 mm) from the neck downwards but only to the middle of the corm, rings well developed, basic ones more or less saw-toothed (<<0,5 mm), no significant teeth on upper ones. Cataphylls 3-4, silvery-white. Leaves many, 3-5,7-8 (n = 35), linear, dark green, glabrous, 1-2,5 mm in diameter, white stripe 1/3 of leaf-diameter, ribs underneath 2, rarely 3 on each grove. Throat yellow to orange, glabrous. Perianth tube white, striped violet at the apex. The inside of all segments is plain white, sometimes veined greyish-blue, corresponding to outer markings which are shining through. Outer segments between 21 and 34 mm (n = 35) but usually 26 mm long, between 5 and 10 mm but usually 7,9 mm wide (n = 35), more or less conspicuously striped or feathered violet to aubergine-coloured, brownish towards the perianth tube, no spots. Inner segments between 20 and 33 mm but usually 25 mm long (n = 35), between 5 and 11 mm but usually 8,2 mm wide (n = 35), plain white, rarely faintly marked, brownish or violet towards perianth tube, no spots. Prophyll absent. Bract and bracteole present, silvery-white, skinny. Filaments 3-4,5-6 mm long (n = 35), deep yellow, without hair. Anthers 5-9,8-12 mm long, 79% blackish, 21% yellow (n = 34), scimitar-shaped, tips and lower ends rounded. Connectives mostly white (colourless), sometimes blue, black or greyish, especially towards the apex, pollen yellow. Styles divided into 3 branches, irregular edged but not trumpet-shaped, mainly orange, length of branches 4-6,3-8 mm (n = 44). Style length according to stamen is 97% shorter to equal, 3% longer (n = 35). Capsule and seeds not seen. Chromosome number (2n = 8).

Crocus taseliensis is phylogenetically (ITS region) closely allied to *C. isauricus* Siehe ex Bowles from the Sertavul region in Isauria near the border of Içel and Karaman provinces. This region is the assumed "type region" of *C. isauricus* but was never traced back (*Crocus biflorus* subsp. *isauricus* according

to MATHEW, 1982). *Crocus taseliensis* differs from *C. isauricus* from this region by 3 bp in ITS. It has many leaves (median of 6, but up to 8) with 2(3) ribs in the grooves on the underside. Remarkable are the two well-separated colours of the anthers, more than 2/3 are blackish, about 1/3 pure yellow but none in between. Almost all the styles are significantly shorter than the stamen.

D i s t r i b u t i o n a n d h a b i t a t: *Crocus taseliensis* is known to us from three areas all located in the Taşeli Yaylası, Isaurian Taurus in the Içel Province of S Turkey. It was found unexpectedly only in soils upon calcareous rocks, together with *Cedrus libani*, *Abies cilicica*, *Quercus*, *Cyclamen cilicium*, *Anagyris foetida*, *Acer*, *Verbascum* etc.

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

H o l o t y p u s: Turkey, Lycia, Muğla Province, N-Babadağ, 1200 m, 21.3.1997, HKEP 9708 (Gatersleben, GAT 7185).

Cormus globosus, 1,5-2,5 cm diam. Tunica coriacea, separata in segmenta lata cum annulis indistinctis ad basem. Cataphyllae argenteae usque ad brunneolas. Folia 3-4,6-8, atrovirida, glabra, 1-2 mm lata, subter sine costis. Corolla fauce straminea usque ad saturate flavum, plerumque glabra ad insertionem filamentorum. Perianthii tubus maculatus brunneolus, sine striis. Paginae segmentorum interiorum totae albae, usque ad dilute lilacinum. Segmenta exteriora 19-24-28 mm (n = 26) longa, 5-7,3-13 mm (n = 26) lata. Segmenta interiora 17-22-26 mm (n = 26) longa, 5-8-11 mm (n = 26) lata. Segmenta exteriora extus alba usque ad bubalina-violacea, intense maculata brunneola-violacea. Segmenta interiora extus alba usque ad dilute lilacina. Prophyllum absens. Bractea et bracteola adsunt, argentea usque ad brunneolum. Filamenta 5-6,7-9 mm (n = 26) longa, saturate lutea usque ad aurantiacum, raro pubescens. Antherae 7-9,6-11 mm (n = 26) longae, sagittatae, luteae, interdum griseae ad apicem. Connectivum sine colore usque ad pallide flavum. Stylus saturate luteus usque ad aurantiacum, divisus in ramos tres. Rami stigmatici 5-**6,6**-9 mm (n = 23). Capsula non visa. Chromosomatorum somaticorum numerus 8.

Corm spherical, 1,5-2,5 cm in diameter. Tunics coriaceous, splits only into broad segments, rings poorly developed, their edges plain or slightly pronged (<<05 mm), no teeth. Cataphylls silvery to brownish. Leaves 3-**4,6**-8, dark green, glabrous, 1-2 mm in diameter, linear, white stripe in general more than 1/3 of leaf-diameter, no ribs underneath. Throat light to deep yellow, mostly without hair. Perianth tube intensively speckled brownish, no stripes. Inside of all segments is white to faint lilac. Outer segments between 19 and 28 mm but usually 24 mm long (n = 26). The segments are sometimes unusually deep divided, giving the impression of being almost separate, they are white to buff-coloured, intensively speckled brownish-violet, in some specimens three stripes are indicated by speckles in shades, darker towards the perianth tube, no spots, yellow throat shining through. Width of outer segments 5-**7,3**-13 mm wide (n = 26). Inner segments between 17 and 26 mm but usually 22 mm long (n = 26), and between 5 and 11 mm but usually 8 mm wide (n = 26), plain white to faint lilac, sometimes darker towards the perianth tube, yellow throat shining through. Prophyll absent. Bract and bracteole present, silvery to brownish, especially at the tips, skinny. Filaments 5-**6,7**-9 mm long (n = 26), deep yellow to orange, rarely with hair. Anthers 7-**9,6**-11 mm, subulate arrow-shaped, rather narrow, yellow, sometimes getting greyish to the top, lower ends mostly flabby and turned aside. Connective mainly prominent, colourless to light yellow, often greyish towards the apex. Styles divided into 3 branches, deep yellow to orange, on the top only fringed, not significantly broader, length of branches 5-**6,6**-9 mm (n = 23). Styles 84% shorter to equal, 16% longer according to stamen (n = 26). Capsule and seeds not seen. Chromosome number (2n = 8).

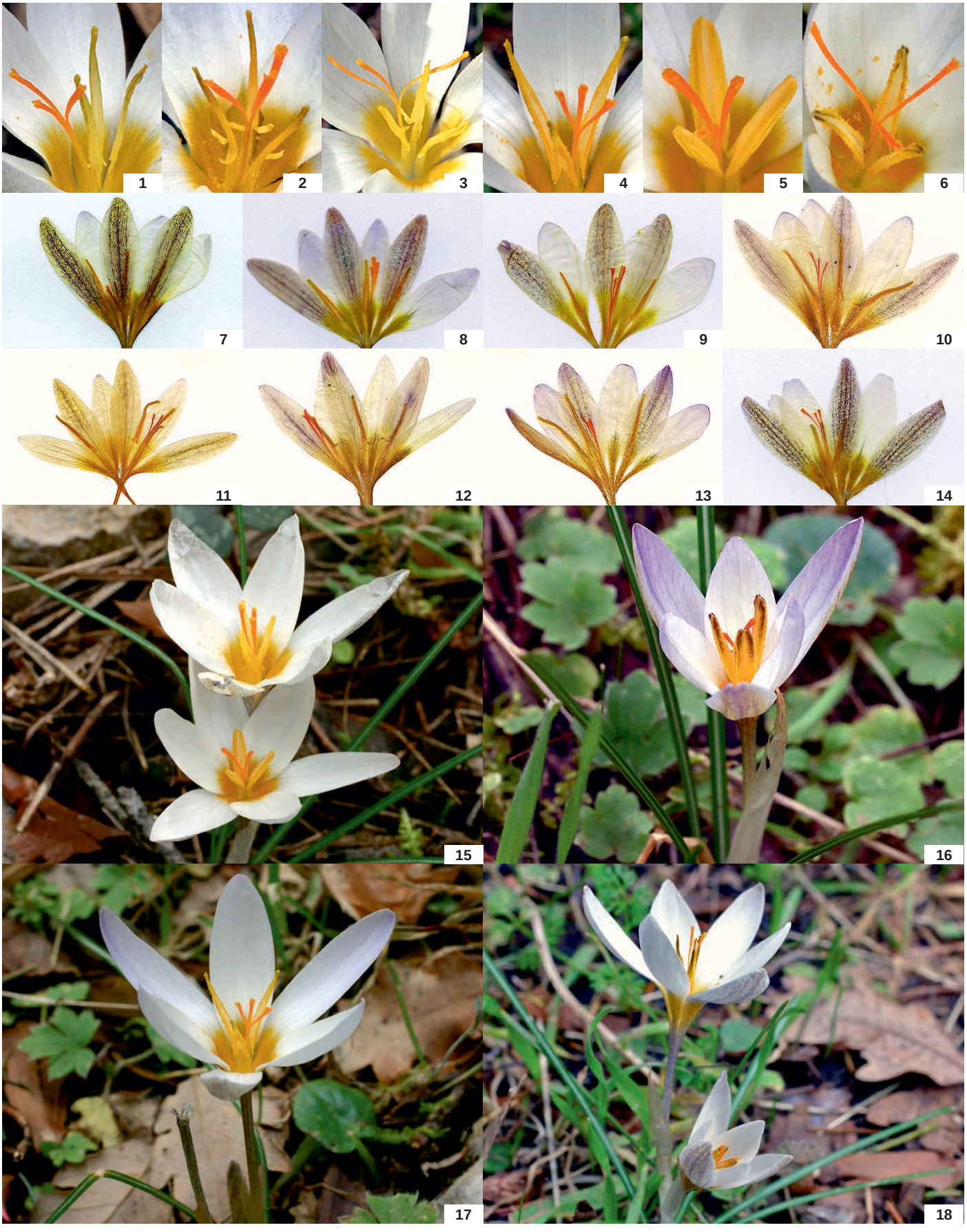
Crocus babadagensis, like *C. mersinensis*, unexpectedly groups with *C. biflorus* from Italy (GAT 7198) and Greece (DB 4387) in the ITS phylogeny. From the geographical and morphological point of view it is clearly distinguishable from these taxa. The outside of the outer segments is speckled brownish-violet more resembling those of *C. punctatus*, but never with black tips at the lower ends of the anthers. Cataphylls, bracts and bracteoles always have the otherwise uncommon brownish upper ends. Filaments are fairly long of almost 7 mm in average (max. = 9 mm). Very strange are the narrow, subulate arrow-shaped anthers with mostly flabby and curvy lower ends, becoming greyish or grey-edged at their tops. Remarkable are also the short styles, which are in 84% of 26 investigated individuals shorter to equal to the length of the stamen.

D i s t r i b u t i o n a n d h a b i t a t: *C. babadagensis* is as yet known to us only from its type locality high up in the Babadağ mountain stock in Muğla province, Turkey. It grows only on limestone rocks, among *Pinus brutia*, together with *Quercus coccifera*, *Cedrus libani*, *Juniperus*, *Daphne gnidioides*, *Anemone coronaria*, *A. blanda*, *Cyclamen alpinum*, *Crocus fleischeri*, *C. cancellatus*, *C. antalyensis*, *Berberis crataegina*, *Verbascum* etc.

4. *Crocus simavensis* KERNDORFF & PASCHE, species nova

H o lo t y p u s: Turkey, Mysia, Balikesir Province, north of Simav, 1000-1400 m, 15.03.2009, HKEP 0911 (Gatersleben, GAT 7243).

Cormus subglobosus, ca. 1 mm diam. Tunica coriacea, separata in segmenta angusta cum annulis distinctis ad basem; collum 2-3 mm longum. Cataphyllae 2-4, argenteae, interdum cum margine brunneola. Folia 2-3,3-5, atrovirida, glabra, 1- (1,5) mm lata, folia nervis utroque costae latere 2-3. Faux lutea, glabra, interdum cum zona violacea ad basem. Perianthii tubus albidus, violaceus ad apicem. Paginae segmentorum interiorum totae albae vel lilacinae; segmenta exteriora 15-22-30 mm (n = 30) longa, alba-lilacina vel violacea, extus striata vel pinnata caerulea vel violacea, 6-8,8-16 mm (n = 30) lata; segmenta interiora 15-21-28 mm (n = 30) longa, alba usque ad lilacina, 6-8,8-11 mm (n = 30) lata. Prophyllum absens. Bractea et bracteola adsunt, argentea. Antherae 5-7,5-10 mm (n = 30) longae, sagittatae, rotundatae ad apicem, caeruleae, nigrae, griseae, saturate viridae vel pallide viridae. Connectivum albidum ad basem, versus apicem caerulescens, nigrescens, cinerascens vel viridescens. Stylus plerumque luteus, raro aurantiacus, divisus in partes tres. Rami stigmatici 3-**5,0**-7 mm (n=28). Capsula non visa. Chromosomatorum somaticorum numerus 12.



Colour plate 3: *Crocus babadagensis* (HKEP 9708), scaled flower parameters, 1-6, flower variations, 7-14, type locality photographs, 15-18.

Colour plate 4: *Crocus simavensis* (HKEP 0911), scaled flower parameters, 1-6, flower variations, 7-14, type locality photographs, 15-18.

Corm subglobose, around 1 cm in diameter. Tunics coriaceous, inner softer, neck inconspicuous (2-3 mm long), splits of main tunic into relatively small bands (1-2 mm) which are subdivided into much smaller bands (<0.,5 mm); rings well developed, near base entire-edged or slightly pronged, upper ones strongly toothed. Teeth conspicuous, many and very long (2-5 mm). Cataphylls 2-4, silvery, sometimes with brownish edges. Leaves few, 2-**3,3**-5, linear, getting somewhat broader towards the basis, dark green, glabrous, 1-(1,5) mm wide, white stripe smaller than or up to 1/3 of leaf-diameter, ribs underneath 2-3 on each side of the blade. Throat yellow, sometimes with a small deep violet throat below, no hair. Perianth tube whitish, violet near apex, no stripes. Inside all segments are plain white or lilac with markings of the outside sometimes shining through. Outer segments between 15 and 30 mm but usually 22 mm long, between 6 and 16 mm but usually 8,8 mm wide (n = 30), white, lilac or deep violet, featherings or striping blue to violet, often very faint. Inner segments between 15 and 28 mm but usually 21 mm long, between 6 and 11 mm but usually 8,8 mm wide (n = 30), plain white, lilac or light violet, generally without markings, brownish towards perianth tube, no spots but the yellow of throat shining through. Prophyll absent. Bract and bracteole present, conspicuous, silvery, skinny. Filaments 3-**6,1**-8 mm long (n = 30), deep yellow to orange, no hair. Anthers 5-**7,5**-10 mm long (n = 30), broadly arrow-shaped, tops rounded, lower peaks very short, blue, black, greyish, grey-green, light green, and one yellow out of n = 30. Connective whitish at the base, becoming blue, black, greyish or greenish towards the apex. Styles divided into 3 branches not markedly trumpet-shaped, frequently yellow, rarely orange, branches 3-**5,0**-7 mm long (n = 28). Style length according to stamen 83% longer to equal, 17% shorter (n = 30). Capsule and seeds not seen. Chromosome number (2n = 12).

Crocus simavensis harbours two different types of the ITS region, which might indicate an allopolyploid state. One type is unique within the genus and groups, although with marked differences, with a *C. chrysanthus* we found on the Karıncalı Dağları (HKEP1105). The closest relatives of the second ITS type of *C. simavensis* is a group consisting of *C. lydius* (HKEP 0606), *C. ionopharynx* (HKEP 0306), *C.mysius* (HKEP 0711).

Crocus simavensis is a beautiful crocus reaching certainly the highest variability of individuals we have ever seen in a crocus population. This is not only valid for the measured parameters but also for the form of flowers, their colours and markings, for the shapes and colours of connectives and anthers (see description). Nevertheless, it has further remarkable features, like well-developed rings of the corm tunic, of which the upper ones are strongly toothed. There are many conspicuous and comparatively long (2-5 mm) teeth on the rings. Mathew (1982) dismissed the possible importance of such teeth of the corm tunic rings as he assumed that they "…occur rather haphazardly and appear to be of little taxonomic use" (Mathew, 1982: page 84). Our field studies show that this might not be the case, but this will be dealt with elsewhere. The filaments are almost as long as the anthers (81% of 30 individuals) and the styles are overtopping to equalizing the stamen in 83% of the investigated 30 specimens, the rest is shorter than the stamen.

D i s t r i b u t i o n a n d h a b i t a t: *C. simavensis* occurs very locally in the northern environs of Simav in Balikesir Province, Turkey. The type locality covers different geological facies. This could mean the plant is rather indifferent concerning soil types. The type locality is characterised by open oak forests and shrubs, found together with *Crocus chrysanthus.*

5. *Crocus mysius* KERNDORFF & PASCHE, species nova

H o lo t y p u s: Turkey, Mysia, Balikesir Province, SE of Balikesir, 600-800 m, 18.03.2007, HKEP 0711 (Gatersleben, GAT 7386).

Cormus subglobosus, 1-1,5 cm diam., separata in fibras latas cum annulis paucis ad basem. Cataphyllae 2-4, argenteae-albae. Folia 3-3,7-5 (n = 33), 1-1,5 mm latae, subter cum 2-3 costis, raro 4. Corolla fauce lutea usque ad saturate aurantiacum, glabra. Perianthii tubus pallidus usque ad saturate violaceum, albescens ad basem. Segmenta exteriora et interiora intus alba usque ad pallida lilacina. Segmenta exteriora 20-26-32 mm (n = 33) longa, alba, lilacea raro violacea, brunneola ad basem, 6-9,3-13 mm (n = 33) lata. Segmenta interiora 19-25-32 mm (n = 33) longa, 6-9,8-14 mm lata, alba vel pallide lilacea, brunneola ad basem. Prophyllum absens. Bractea et bracteola argentea-alba. Filamenta 6-8,2-10 mm (n = 33) longa, saturate lutea usque ad aurantiaca. Antherae 6-7,8-11 (n = 33) longae, sagittatae, saturate caeruleae, atroviolaceae vel saturate brunneae. Connectivum caeruleum, violaceum, nigrum vel griseo-virens, albescens ad basem. Rami stigmatici 3, saturate flavi, raro aurantiaci. Rami stigmatici 3-**5,7**-10 mm (n=47). Capsula non visa. Chromosomatorum somaticorum numerus 10.

Corm subglobose, 1-1,5 cm in diameter. Tunics coriaceous, inner softer, splits into broad segments which are irregularly subdivided at the lower end into very small and short bands; rings if present few, near the base with entire edges, the upper ones with many fine teeth of different height, the longest about 1,5 mm. Cataphylls 2-4 silvery white. Leaves 3-**3,7**-5 (n = 33), 1-1,5 mm wide, almost linear, getting slightly broader towards base, dark green, glabrous, white stripe smaller than 1/3 of leaf-diameter, 2-3 (rarely 4) ribs in the grooves of underside. Throat yellow to deep orange, sometimes with a deeper violet one, no hair. Perianth tube mostly light to deep violet, whitish towards base. Inside all segments are plain white to faintly lilac. Outer segments between 20 and 32 mm but usually 26 mm long, between 6 and 13 mm but usually 9,3 mm wide (n = 33), either plain white, lilac or (rarely) violet or with faint markings or speckles, no featherings or stripes, towards perianth tube brownish, but no spots. Inner segments between 19 and 32 mm but usually 25 mm long, between 6 and 14 mm but usually 9,8 mm wide (n = 33), plain white or slightly lilac, towards the perianth tube brownish. Prophyll absent. Bract and bracteole present, silvery-white, skinny. Filaments conspicuously long (6-**8,2**-10 mm, n = 33), deep yellow to orange. Anthers 6-**7,8**-11 mm long, rather short, broadly arrow-shaped with flabby lower ends, deep blue, blackish-violet, or deep brown. Connective blue, violet, black, or greyish-green, towards the base becoming whitish. Style divided into three branches 3-**5,7**-10 mm long (n = 47), not markedly widened of fringed at the apex, deep yellow or orange. Style length according to stamen 91% shorter to equal, and 9% longer of the investigated specimens. Capsule and seeds not seen. Chromosome number (2n = 10).

Crocus mysius is phylogenetically (ITS region) allied to *C. lydius* (HKEP 0606), *C. ionopharynx* (HKEP 0306) and to one

form of *C. simavensis* (HKEP 0911). The corm tunic has many rings with teeth as in *C. simavensis* but compared to this they are very thin with a maximum length of 1,5 mm, mostly less than 1 mm. The flowers are never striped or feathered, mostly plain coloured with faint markings on the outside. Remarkable is, that the anthers are in average only 95% of the size of the filaments, which are very prominent and deep yellow to orange. The styles are regularly shorter to equal the stamen.

Distribution and habitat: *C. mysius* is until now only known from the type locality in the south-eastern environs of Balikesir, Balikesir Province, Turkey. The type locality is characterized by open forest, meadows and rocky places. Together with the crocus one can find *Pinus*, *Juniperus*, *Rubus*, *Quercus*, *Cistus laurifolius*, *C. creticus*, *Acantholimon*, *Salvia*, *Scilla bifolia*, *Crocus flavus*, thistles etc.

6. *Crocus bifloriformis* Kerndorff & Pasche, Kerndorff & Pasche stat. nov. *Crocus biflorus* subsp. *biflorus* B. Mathew, in Mathew, 1982.

Holotypus: Turkey, Mysia, Çanakkale Province, Dededağı, 900-1100 m, 21.03.2006, HKEP 0602 (Gatersleben, GAT 7384).

Cormus subglobosus, 1-1,5 cm diam. Tunica coriacea, subfusca, collum conspicuum, setosum vel findens ad basem in dentes. Interdum fissa in segmenta lata. Annuli adsunt, serrati (ca. 0,5 mm), vel dentibus minutis, dispositi parvo spatio circum annulos. Cataphyllae 3-4, argenteae. Folia 3-4,4-6 (n = 30), 0,5-1 mm lata, atrovirida, glabra, subter sine costis. Corolla fauce saturate flava usque ad rubroaurantiacum, raro cum macula violacea ad basem. Perianthii tubus albidus, cum striis violaceis vel pallide caeruleis ad apicem. Segmenta interiora intus alba. Segmenta exteriora 17-23-27 mm (n = 30) longa, striata et pinnata violacea, raro maculata, 5-7,6-10 mm (n = 30) lata. Segmenta interiora 15-22-26 mm (n = 30) longa, pallide brunnea ad basem, 5-8,6-11 mm (n = 30) lata. Prophyllum adest. Bractea et bracteola insolenter longa, argentea cum macula brunneola, plerumque manifeste superans basem segmentorum. Filamenta 2-4,1-6 mm (n = 30) longa, saturate lutea usque ad auratiacum. Antherae 8-10,2-15 mm (n = 30) longae, sagittatae, luteae. Connectivum flavum; pollen flavum. Stylus divisus in ramos tres, rami saturate flavi vel aurantiaci. Rami stigmatici 3-**4,9**-7. Capsula non visa. Chromosomatorum somaticorum numerus 10.

Corm subglobose, 1-1,5 cm in diameter. Tunics coriaceous, light brown. Neck conspicuous, bristly or splitting downwards into teeth. Splits into broad segments sometimes with further fine splits. Rings existent, saw-toothed or with very small teeth (smaller or about 0,5 mm) distantly arranged around the rings. Cataphylls 3-4 silvery. Leaves 3-**4,4**-6 (n = 30), 0,5-1 mm long, linear, dark green, glabrous, white stripe 1/3 of leaf-diameter, no ribs in the grooves of the underside. Throat deep yellow to deep orange-red, rarely with a smaller violet one below. Perianth tube whitish, striped violet or bluish towards the apex. Inside all segments are plain white, only markings of outside shining through. Outer segments between 17 and 27 mm but usually 23 mm long, between 5 and 10 mm but usually 7,6 mm wide (n = 30) more or less conspicuously striped and feathered violet, rarely only speckled. Inner segments between 15 and 26 mm but usually 22 mm long, between 5 and 11 mm but usually 8,6 mm wide (n = 30), plain white, becoming yellow to light brown towards the perianth tube. Prophyll absent. Bract and bracteole present, very conspicuous, bract broad and unusually long, both mostly clearly overtopping the base of the segments, silvery but brownish speckled and with brownish tips. Filaments 2-**4,1**-6 mm long (n = 30), deep yellow to orange. Anthers 8-**10,2**-15mm long (n = 30), broadly arrow-shaped with short and rounded tips at the lower end, yellow. Connective yellow, pollen yellow. Styles divided into three filiform branches, length of branches 3-**4,9**-7 mm (n = 31), slightly edged or fringed, deep yellow to orange. Style length according to stamen is 93% shorter to equal, 7% longer. Capsule and seeds not seen. Chromosome number (2n = 10).

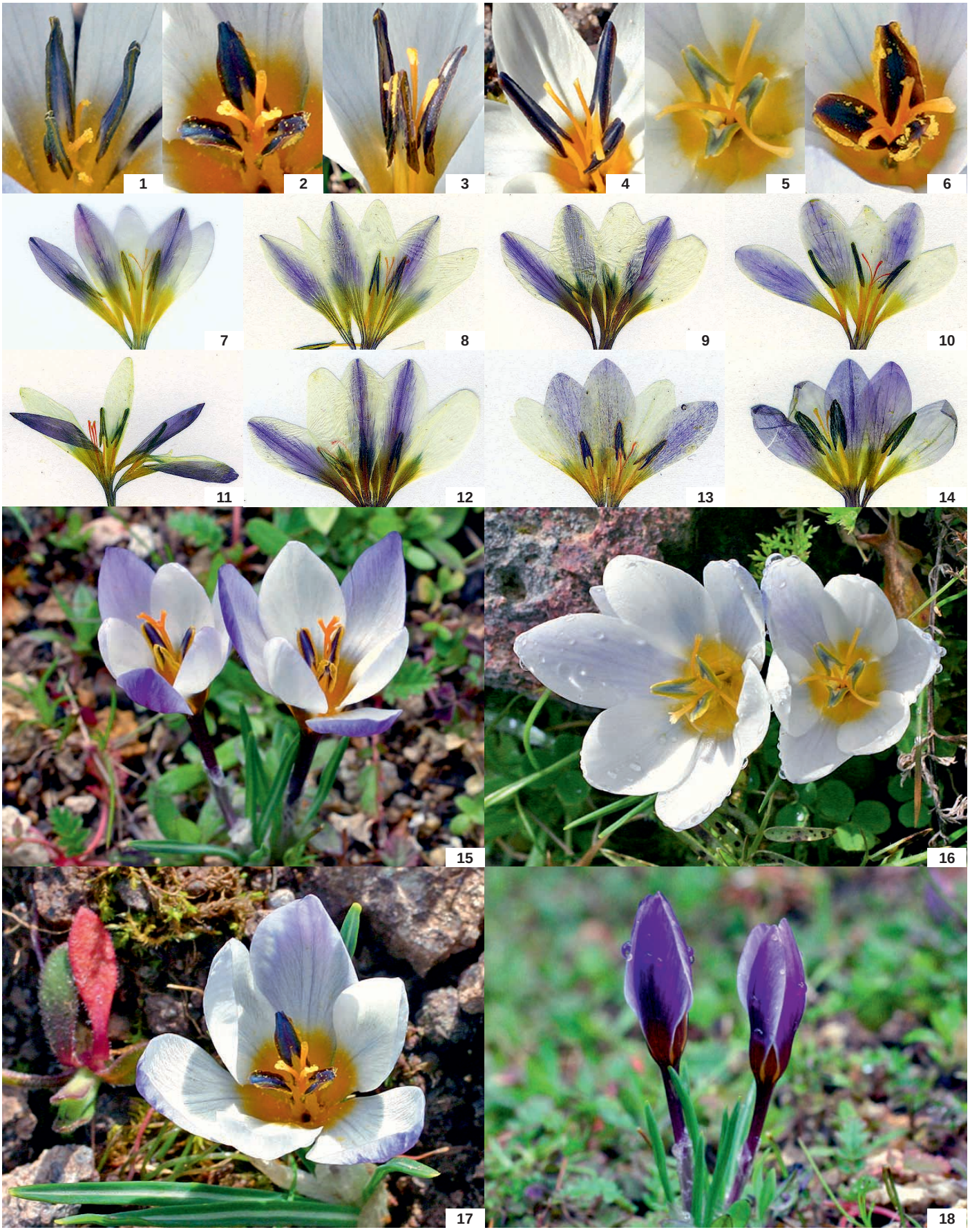
Crocus bifloriformis is known from the Istanbul and Çanakkale region of Turkey. In 1982 it was taxonomically integrated by Mathew into his "*Crocus-biflorus* aggregate" as *Crocus biflorus* subsp. *biflorus*. It has an overall appearance like *C. biflorus* (hence, *Crocus bifloriformis*). The phylogenetic ITS results show, however, a closer relationship to *C. pulchricolor* (4bp difference) instead of *C. biflorus* from Italy. On the other hand, a habitual and morphological comparison of the three species reveals a closer affinity to the Italian *C. biflorus*. Compared to this one, in *C. bifloriformi*s only the upper parts of the cataphylls are getting brownish with age. It is remarkable that the cataphyll stays like this even when the plant is completely in dormancy. Furthermore, it has longer anthers (8-**10,2**-15) mm, instead of 6-11 mm in *C. biflorus*. Bract and bracteole are very conspicuous, normally clearly overtopping the perianth tube, with narrow skinny and always brownish tops. Also, of 31 investigated specimens the anthers are 93% shorter to equal of the stamens, while in *C. biflorus* they are equal or exceeding the stamens. Compared to *C. pulchricolor* of course the colour is clearly differentiating both macroscopically, white in *C. bifloriformis* and deep bluish violet in *C. pulchricolor* but colours are often illusive in taxonomic differentiation. Geographically, both species are well separated but the distance of *C. bifloriformis* to the nearest locality of *C. pulchricolor* (Ulu dağ, near Bursa) is only about 200 km whereas the distance to the mainland of *C. biflorus* (Italy) is much larger.

Distribution and habitat: We have seen some more populations of *C. bifloriformis* in the Çanakkale Province (Dededağı), along the Dardanelles and in parts of the southern Marmara coast in NW Turkey. It thrives in light pinewoods, open shrubs and meadows among *Quercus coccifera*, *Pinus brutia*, *Cistus creticus*, *Asphodelus aestivus*, *Juniperus*, *Asparagus*, *Ruscus aculeatus*, and also *Crocus candidus*. The smell of *C. bifloriformis* is a bit like that of *Crocus graveolens*. The species grows mainly on calcareous soils.

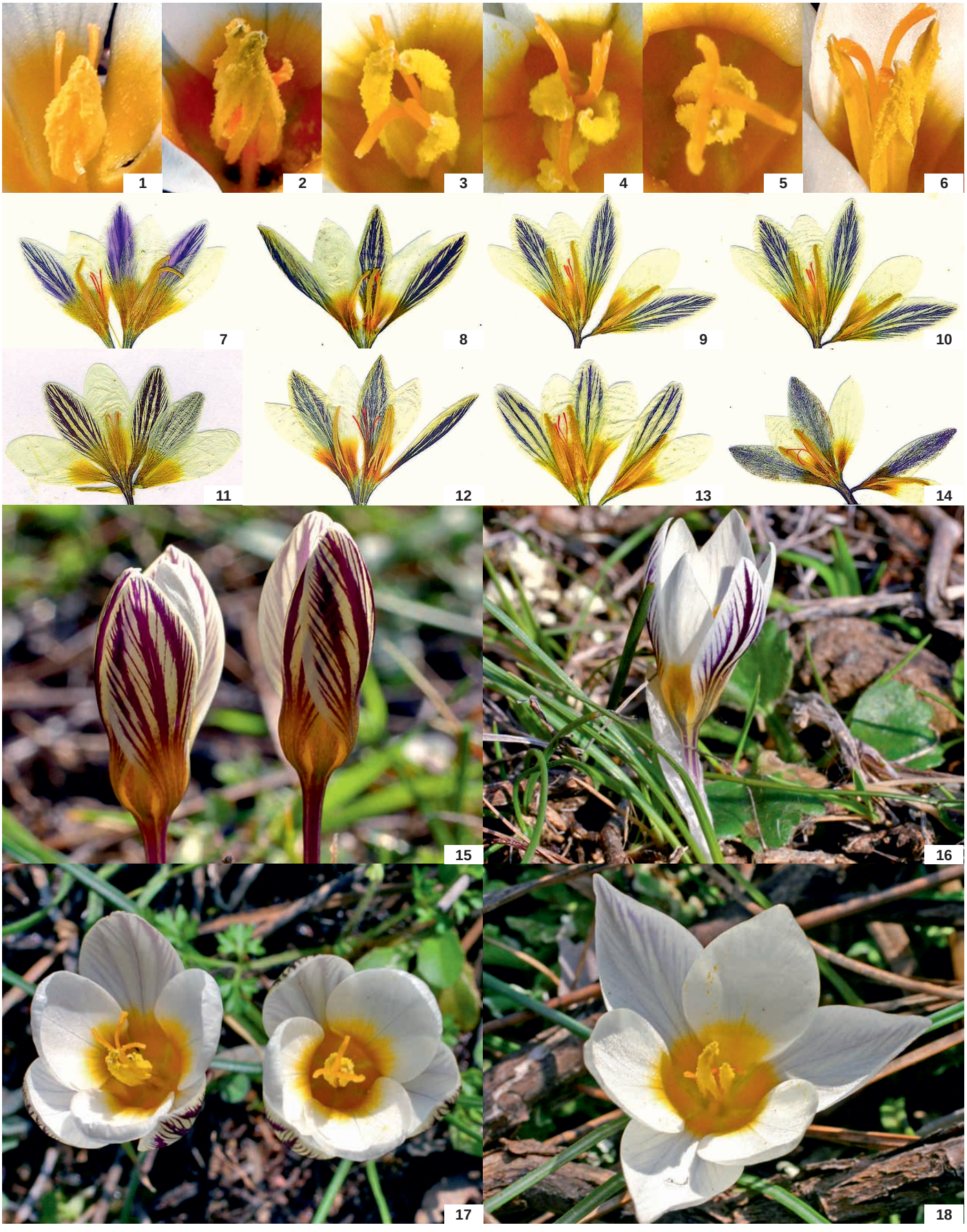
7. *Crocus adamioides*, Kerndorff & Pasche, Kerndorff & Pasche stat. nov., *C. biflorus* subsp. *adamii* B. Mathew, in Mathew, 1982

Holotypus: Turkey, Kirklareli Province, Yildiz Dağları, 900-1100 m, 20.03.2009, HKEP 0904 (Gatersleben, GAT 7136).

Cormus ovoideus, 1-1,5 cm diam. Tunica coriacea, apice in collum setosum producta usque ad 5 mm. Tunica separata in



Colour plate 5: *Crocus mysius* (HKEP 0711), scaled flower parameters, 1-6, flower variations, 7-14, type locality photographs, 15-18.



Colour plate 6: *Crocus bifloriformis* (HKEP 0602), scaled flower parameters, 1-6, flower variations, 7-14, type locality photographs, 15-18.

fibras latas cum annulis ad basem. Cataphyllae 2-4, argenteo-albae usque ad brunneolum. Folia 2-2,9-4 (n = 38), 1 mm lata, (raro 1,5 mm), atrovirida, glabra, interdum leviter ciliata, subter cum 1-2 carinis in omni sulco in folia inferiore. Faux saturate flava usque ad aurantiacum, glabra, interdum sub colore graviore. Perianthii tubus albidus, futurus violaceus versus apicem. Segmenta ad paginam interiorem alba. Segmenta exteriora15-19-25 mm (n = 38) longa, albida, lilacina vel caerulea, nec venosa nec pinnata. Segmenta exteriora 6-8,7-13 mm (n = 38) lata. Segmenta interiora 14-18-24 mm (n = 38) longa, alba vel lilacina, pallide brunneola ad basem, 6-8,8-16 mm (n = 38) lata. Prophyllum adest. Bractea et bracteole albida, raro brunneola ad apicem. Filamenta 2-3,3-6 mm (n = 38) longa, lutea, glabra. Antherae 6-8,8-12 mm (n = 38) longae, sagittatae, flavae, cum connectivo sine colore. Stylus divisus in ramos tres, apex leviter fimbriatus, rubroaurantiacus. Rami stigmatici 3-**4,8**-9 mm (n = 38). Capsula non visa. Chromosomatorum somaticorum numerus 16.

Corm subglobose, diameter 1-1,5 cm. Tunics coriaceous, inner softer, neck bristly, about 5 mm long, splits only into broad segments, rings present, near basis entire-edged, slightly pronged, upper ones clearly toothed. Teeth small (up to 1 mm) clearly separated. Cataphylls 2-4, silvery white to brownish. Leaves rather few, 2-**2,9**-4 (n = 38), 1 mm wide (rarely up to 1,5 mm), tips obtuse, dark green, glabrous, sometimes slightly ciliated, white stripe smaller than 1/3 of leaf-diameter, one, rarely two ribs in each groove on the underside. Throat deep yellow to orange, glabrous, occasionally with a deeper violet one. Perianth tube whitish, becoming violet towards the segments. Inside all segments are plain white to lilac. Outer segments between 15 and 25 mm but usually 19 mm long, between 6 and 13 mm but usually 8.7 mm wide (n = 38), whitish, lilac or blue with faint markings or poorly defined bluish spots, no stripes or feathering, darker close to the perianth tube. Inner segments between 14 and 24 mm but usually 18 mm long (n = 38), plain white or lilac, becoming slightly brownish in direction of the perianth tube. Prophyll present. Bract and bracteole present, whitish, rarely brownish at the tips, skinny. Filaments short, 2-**3,3**-6 mm long (n = 38), yellow, glabrous. Anthers 6-**8,8**-12 mm long (n = 38), broadly arrow-shaped, tips obtuse, lobes short, yellow. Connectives prominent, white/colourless. Styles divided into three branches widened to the top, slightly fringed, orange-red, length of branches 3-**4,8**-9 mm (n = 38). Style length according to stamen 95% longer to equal, 5% shorter, n = 38. Capsule and seeds not seen. Chromosome number (2n = 16).

This crocus is known already for a long time but it was thought by MATHEW (1982) to belong to his subsp. *adamii* of *C. biflorus*. As our phylogenetic results of the ITS analysis of the genus crocus show, *C. adamioides* is neither closely allied to *C. biflorus* nor to its subspecies *adamii.* Instead, it is allied to *C. danfordiae*, *C. leucostylosus*, *C. punctatus*, and *C. pulchricolor*. All of those differ at 3-5 bp in their ITS sequences compared to *C. adamioides*. Mathew´s taxon "*C. biflorus* ssp. *adamii"* is, as we now know, confined to the areas of the northern Anatolian Diagonal and east of it (NE Turkey, Caucasus, SW Georgia, Armenia, N Iraq, and NW Iran) (HARPKE et al. 2011). It will be given back the rank of a species and will become the basic taxon of a new large series "Adami" in a new taxonomic treatment of the genus (Kerndorff et al., in prep.).

Crocus adamii of GAY (1831) in RANDJELOVIĆ et al. (1990) is located in Serbia in the regions of Timok, Niš, and south Morava. From the photograph shown in this work it has obviously some affinity to *C. biflorus* subsp. *adamii* but also to forms of *C. biflorus* subsp. *nubigena* (MATHEW, 1982). Furthermore, its chromosome number (2n) is 18, in "subsp. *adamii"* from the mentioned eastern countries it is 2n = 20, clearly different from *C. adamioides,* which has 2n = 16. In our opinion, the Serbian plant needs further investigation to clarify its status. However, the crocus is named *adamioides* because its overall appearance resembles that of *C. adamii* GAY.

Distribution and habitat: *C. adamioides* occurs in NW Turkey, Kirklareli Province. It is, as yet known, found only on the northwestern-most mountain ridge of Turkey, the Yildiz Dağları. *Crocus adamioides* grows on slopes in open woods, at the edges of *Quercus* forest in grassy situations together with *Trifolium*, *Ornithogalum*, *Astragalus* etc.

A determination key will be provided for the new taxa above after all new species have been described.

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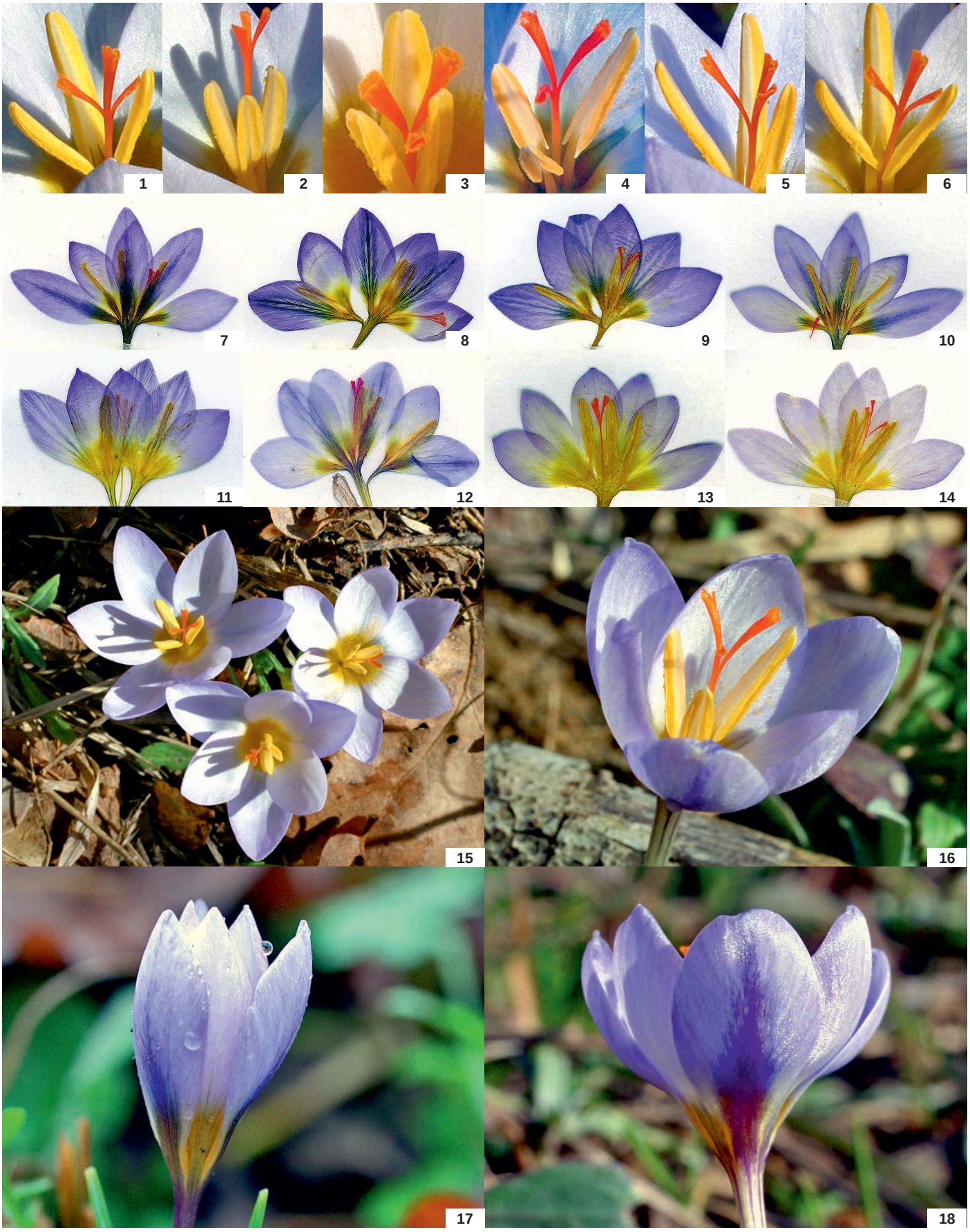

Colour plate 7: *Crocus adamioides* (HKEP 0904), scaled flower parameters, 1-6, flower variations, 7-14, type locality photographs, 15-18.