

Fourteen New Species of *Crocus* (Liliiflorae, Iridaceae) from West, South-West and South-Central Turkey

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

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

Zusammenfassung: Vierzehn neue *Crocus*-Arten aus der westlichen, südwestlichen sowie der zentralen Südtürkei werden beschrieben.

Key words: *Crocus mawii* (HKEP 0413), *Crocus karamanensis* (HKEP 0108), *Crocus abraceolus* (HKEP 1040), *Crocus antherotes* (HKEP 0209), *Crocus tahtaliensis* (HKEP 9716), *Crocus mediotauricus* (HKEP 0112), *Crocus arizelus* (HKEP 0403), *Crocus lyciotauricus* (HKEP 9804), *Crocus ziyaretensis* (HKEP 9820), *Crocus oreogenus* (HKEP 0126), *Crocus calanthus* (HKEP 0123), *Crocus multicarinatus* (HKEP 0401), *Crocus incognitus* (HKEP 0201), *Crocus colereus* (HKEP 0314), western Turkey, south-western Turkey, south-central Turkey.

* Correspondence to: helmutkerndorff@sapo.pt

Introduction

Our systematic investigations of almost 80 Turkish crocus populations in the field revealed many new taxa since 1993 (KERNDORFF & PASCHE 1993, 1994, 1997, 2003, 2004a,b, 2006, 2011, 2012; PASCHE 1993). In this paper we deal with new findings from western, south-western and south-central Turkey, and partly take also into account findings from molecular systematic analysis (HARPKE et al. 2013).

Description of new taxa

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

H o l o t y p u s : Turkey, Pisidian Taurus, Konya Province, Kuyucak Dağı 1600-1700 m, 25.3.2013, HKEP 0413 (Gatersleben, GAT 7130).

Cormus subglobosus, 15-17 mm diameter, tunicae exteriores coriaceae, interiores molles, collum setosum, 5 mm longum, constans ex mediis magnis triangulis; tunica dissecta in segmenta lata (>5mm), subfissurae interdum adsunt, annuli adsunt, coriacei, clare serrati, vel cum dentibus significatis minutis <1 mm, dispositis remotis circum annulos. Cataphyllae argenteae, cum apicibus brunneolis. Folia 4-5.6-7, atrovirida, 1-1.5 mm lata, glabra, folia nervis utroque latere costae (0)1-2. Folia aliter evoluta ad anthesim, et non visibilia et flores superans. Faux saturate lutea usque ad aurantiacum, glabra. Perianthii tubus albus, striatus violaceus ad basim segmentorum. Segmenta externa 24-32 mm, plerumque 28 mm longa (n = 14), 6-10 mm, plerumque 8 mm lata (n = 14). Segmenta interna 22-31- mm, plerumque 26 mm longa, 7-10 mm, plerumque 8 mm lata (n = 8). Segmenta omnia diluta lilacina-caerulea usque ad violacea, cum nervatura molli et magis dilute fusca. Segmenta externa extra ochroleuca, grave venosa, pinnatinervia, raro punctata saturate violacea. Segmenta interna extus saturate lilacina-caerulea, cum macula brunneola vel subcaerulea ad basim. Prophyllum abest. Bractea et bracteola argentea, recutita, raro brunneola ad

apicem. Filamenta 4-5.8-8 mm longa (n = 21), luteola usque ad lutea, glabra. Antherae luteae, sagittatae, 9-11.3-13 mm longae (n = 22). Connectivum late prominens, sine colore usque ad luteolum, pollen flavum. Stylus aurantiacus usque ad rubrum, divisus in ramos tres, rami stigmatici 3-5.3-10 mm longi (n = 21). Longitudo styli longior vel aequomodo quam antherae 73%, brevior 27% (n = 22). Capsula non visa. Semina elongata, 1-1.5 mm lata, 3-3.5 mm longa, saturate brunnea cum caruncula prominenti et raphe indistincta. Chromosomatorum somaticorum numerus incognitus est.

Corm flattened globose, 15-17 mm in diameter, outer tunics coriaceous, the inner ones softer, neck bristly, 5 mm long, consistent of medium sized triangles; splits of tunics into broad segments (>5mm), sub-splits occasionally present, rings present, coriaceous, significantly saw-edged or with distant short teeth <1 mm. Cataphylls silvery-white with light brown tips. Leaves 4-5.6-7, dark green, 1-1.5 mm in diameter, glabrous, white stripe 1/3 to > 1/3 of leaf-diameter, (0)1-2 ribs underneath. Leaves very differently developed at anthesis, from not visible to overtopping the flower. Throat deep yellow to orange, no hair. Perianth tube white, striped violet near the segment-base. Outer segments between 24 and 32 mm but usually 28 mm long (n = 14), between 6 and 10 mm but usually 8 mm wide (n = 14). Inner segments between 22 and 31 mm but usually 26 mm long, between 7 and 10 mm but usually 8 mm wide (n = 8). Inside all segments are light to deep lilac-blue or violet with faint darker veins. Outside of outer segments creamy-white, heavily veined, feathered or rarely speckled deep violet (Fig. 1d). Outside of inner segments intense lilac-blue with faint markings but a brownish or bluish spot towards the perianth tube, rarely similar striped as the outer segments. Prophyll absent. Bract and bracteole present, silvery, skinny, rarely with brownish tips. Length of filaments 4-5.8-8 mm (n = 21), light yellow to yellow, no hair. The anthers are yellow, broadly to narrowly arrow-shaped, either with an acute or circle-like blunt top (Fig. 1c), 9-11.3-13 mm long (n = 22). Connective broadly prominent, colourless, light yellow or rarely in the upper part blackish; pollen yellow. Style orange to red, divided into 3 branches, often tight together like an undivided style, branches 3-5.3-10 mm long (n = 21). Style length according to stamen is in 73% longer to equal, in 27% shorter (n = 22). Capsule not seen. Seeds elongated, 1 to 1.5 mm broad, 3-3.5 mm long, very dark brown with a prominent caruncle and an indistinct raphe. Chromosome number unknown.

Distribution and habitat. To George Maw we dedicate this very beautiful crocus to memorize him and his unique “A Monograph of the Genus *Crocus*” published in 1886. Until now *Crocus mawii* is only known from the type locality in the Kuyucak Mountains in Konya Province. The plant grows together with *Juniperus*, *Pinus brutia*, *Astragalus*, *Arabis*, *Sedum* etc.

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

H o l o t y p u s: Turkey, Isaurian Taurus, Karaman Province, central Taurus, 1500-1600 m, 5.3.2001, HKEP 0108 (Gatersleben, GAT 23070).

Cormus globosus, 13-17 mm diameter; tunicae exteriores coriaceae, interiores molles, collum 3-10 mm longum, constans

ex triangulis aut brevibus aut mediis magnis cum brevi medio magno prolongato collo in acres fines formantes collum setosum; fissurae tunicarum imprimis 2-5 mm longae, raro subfissurae < 5 mm. Annulli adsunt, non abundantes, coriacei, divaricati raro cum dentibus, si adsunt minores quam 0.5 mm. Cataphyllae argenteae-albae. Folia 3-4.9-7, grisea-virida, 1.5 mm diameter, glabra. Folia raro attingentia flores florescentes, 1(2) costis in omni sulco in folio inferiore, numquam superantia flores. Faux lutea, paulo minuta, glabra. Perianthii tubus albus, versus segmenta violacea vel striata violacea. Segmenta externa 21-42 mm, plerumque 27 mm longa (n = 33), 5-10 mm, plerumque 8 mm lata (n = 33). Segmenta interna 20-42 mm, plerumque 26 mm longa, 5-11 mm, plerumque 8 mm lata (n = 33). Latera exteriora et interiora intus alba. Latera exteriora segmentorum exteriorum alba usque ad bubalina raro sine macula, saepe grave pinnatinervia atrovioacea. Latera exteriora segmentorum interiorum recte sine macula, interdum cum macula dilute caerulea vel brunneola, saepe radiata versus medium segmentorum. Prophyllum abest. Bractea et bracteola adsunt, argentea, recutita. Filamenta 4-6-8 mm longa (n = 30), saturate lutea, glabra. Antherae acutatae sagittatae, 59% nigrae, 18% luteae, 23% luteae cum nigro in superiore tertia parte (n = 39), 7-10-15 mm longae (n = 33). Connectivum sine colore usque ad dilute luteum, pollen flavum. Stylus luteus usque ad aurantiacum, divisus in ramos tres, saepe fimbriatus ad apicem, rami 4-7-12 mm longi (n = 32). Styli antheris breviores vel aequilongi 70%, longiores 30% (n = 33). Capsula non visa. Semina castanacea, irregularia ovata, cum raphe et caruncula prominenti. Chromosomatorum somaticorum numerus 10.

Corm globose, 13-17 mm in diameter; outer tunics coriaceous, the inner ones little softer, neck variable in size and form, between 3-10 mm long, consistent of short to medium-sized triangles with short to medium-sized prolongations into peaky tips forming a bristly neck; splits of tunics mainly 2-5 mm long, sub-splits of <0.5 mm existent but rare; rings present, not abundant, coriaceous, frequently pronged, rarely with teeth, if present then less than 0.5 mm long. Cataphylls silvery-white. Leaves 3-4.9-7, greyish-green, 1.5 mm in diameter, glabrous, white stripe 1/4 - 1/2 of leaf-diameter, 1(2) ribs underneath. Leaves at anthesis rarely reaching the flowers, never overtopping them. Throat yellow, rather minute, no hair. Perianth tube white, towards the segments violet or striped violet. Outer segments between 21 and 42 mm but usually 27 mm long (n = 33), between 5 and 10 mm but usually 8 mm wide (n = 33). Inner segments between 20 and 42 mm but usually 26 mm long, between 5 and 11 mm but usually 8 mm wide (n = 33). Inside all segments are white. Outsides of outer segments are white to buff-coloured, rarely without markings, frequently feathered heavily dark violet (Fig. 1f, h). Outside of inner segments normally without markings but sometimes with a bluish or brownish spot near the perianth tube, which is often radiated towards the middle of the segment. Prophyll absent. Bract and bracteole present, silvery, skinny. Length of filaments 4-6-8 mm (n = 30), dark yellow, no hair. Anthers acutely arrow-shaped, 59% black, 18% yellow, and 23% yellow with black upper third (n = 39), 7-10-15 mm long (n = 33). Connective colourless to light yellow, pollen yellow. Style yellow to orange, divided into 3 branches, often fringed at apex, branches 4-7-12 mm long (n = 32). Style length according to stamen is in 70% shorter to equal, in 30% longer (n = 33). Capsule not seen. Seeds deep chestnut-brown, irregularly oval with a prominent raphe and caruncle. Chromosome number 2n = 10.

Distribution and habitat. Until now *C. karamanensis* is only known from the very remote and high positioned type locality in the central Taurus Mountains south of the Göksu valley in Karaman Province. The plant grows together with *Berberis*, *Crataegus*, *Juniperus*, *Amygdalus*, *Astragalus*, *Colchicum*, *Viola*, *Silene*, *Euphorbia*, *Anemone*, *Hyacinthella*, *Thymus* etc.

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

Holotypus: Turkey, Cilician Taurus, Mersin Province, Bolkar Dağlar, 2100-2400 m, 19.3.2010, HKEP 1040 (Gatersleben, GAT 7169).

Cormus globosus, 12-15 mm diameter, tunicae exteriores et interiores coriaceae, collum 3-7 mm longum; constans comparate ex angustis triangulis in basi; triangula prolongata abrupte in fibras tenuissimas, acutatas ad apicem, facientia collum setaceum, si prolongatum usque ad dentes 7 mm; fissura segmentorum in segmentis latis 2.5 mm, sine subfissuris. Annuli adsunt, coriacei, raro molles, divaricati ad marginem dentibus parvis vel multis brevissimis dentibus plerumque <0,5 mm. Cataphyllae argenteae albae, brunneolae ad apicem. Folia 4-4.1-6, virida, 1-2 mm diameter, glabra, 2(3) costis in omni sulco in folio inferiore. Folia evoluta breviora vel attingentia flores ad anthesim. Faux saturate lutea usque ad aurantiacam, glabra. Perianthii tubus albus, subcaeruleus vel dilute violaceus ad apicem. Segmenta exteriora 17-27 mm, plerumque 22 mm longa (n = 25), 5-10 mm, plerumque 8 mm lata (n = 25). Segmenta interiora 16-24 mm, plerumque 20 mm longa, 5-11 mm, plerumque 8 mm lata (n = 25). Latera exteriora et interiora intus alba sine maculis. Latera exteriora segmentorum exteriorum alba, raro suffusa caerulea, punctata, venosa et pinnatinervia variabilia. Latera exteriora segmentorum interiorum alba, raro cum maculis brunneolis versus perianthii tubum, ambiens subcaeruleum. Prophyllum abest. Bractea adest, conspicua, argentea, recutita, tubularis, dichotoma. Bracteola abest. Filamenta saturate aurantiaca, glabra, 3-5-5.5 mm longa (n = 25). Antherae sagittatae, luteae, 6-8.7-11 mm longae (n = 25). Connectivum album usque ad luteolum, raro nigrum in supera tertia parte antherae, pollen flavum. Stylus aurantiacus-rubrus usque ad rubrum, divisus in ramos tres, distinctus expansus et fimbriatus ad apicem, rami stigmatici 4-6-8 mm longi (n = 24). Stigma antheris longior vel aequalis 88%, brevior 12% (n = 25). Capsula et semina non visa. Chromosomatorum somaticorum numerus 10.

Corm globose, 12-15 mm in diameter, outer and inner tunics coriaceous, the inner ones also coriaceous, neck between 3 and 7 mm long, consistent of comparatively narrow-based triangleles which are prolonged abruptly into very thin fibres, acute at the top, making the neck bristly when prolonged up to 7 mm; splits of tunics into 2-5 mm broad segments, no sub-splits; rings existent, coriaceous or (rarely) softer, pronged at the edge or minutely toothed with many but very short teeth of mostly < 0.5 mm. Cataphylls silvery-white, brownish at tips. Leaves 4-4.1-6, grey-green, stiffly erect, 1-2(3) mm in diameter, glabrous, white stripe <1/3 to 1/3 of leaf-diameter, (2)3 ribs underneath. Leaves at anthesis smaller than or reaching the flowers. Throat deep yellow to orange, glabrous. Perianth tube white, bluish or light violet near apex. Outer segments between 17 and 27 mm but usually 22 mm long (n = 25), between 5 and 10 mm but usually

8 mm wide (n = 25). Inner segments between 16 and 24 mm but usually 20 mm long, between 5 and 11 mm but usually 8 mm wide (n = 25). Inside all segments are white without markings. Outsides of outer segments are white, rarely suffused blue with highly variable mixtures of pale to deep violet speckles, veins and featherings (Fig. 1i, j, l). Outside of inner segments white rarely with a brown spot towards the perianth tube which can have a bluish surrounding. Prophyll absent. Bract present and conspicuous, silvery, skinny, tubular with two peaks; bracteole absent. Length of filaments 3-5-5.5 mm (n = 25), yellow, no hair. Anthers arrow-shaped, yellow, 6.5-8.7-11 mm long (n = 25). Connective colourless to light yellow; pollen yellow. Style dark yellow to orange, divided into 3 branches which are not significantly expanded or fringed at the apex, branches 4-6-8 mm long (n = 24). Style length according to stamen is in 88% longer to equal, in 12% shorter (n = 25). Capsule and seeds not seen. Chromosome number 2n = 10.

Distribution and habitat. Until now *C. abracteolus* (= without a bracteole) is only known from the high type locality in the Bolkar Mountains in Mersin Province. This very remarkable crocus lacking a bracteole grows in alpine meadows only on calcareous soils together with *Iris danfordiae*, *Acantholimon*, *Juniperus* etc.

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

Holotypus: Turkey, Caria, Muğla Province, Madranbaba Dağları, 1500-1800 m, 27.3.2002, HKEP 0209 (Gatersleben, GAT 23072).

Cormus magnus, 20-22 mm diameter. Tunicae exteriores et interiores coriaceae, collum conspicuum, 8-12 mm longum, constans ex triangulis basi lata, commutatione repentina in acutas, longas et graciles fibras; tunicae fissae in segmenta 2-5 mm longa, raro subfissurae, pro eo incisurae multae < 1 mm; Annuli adsunt, coriacei et conspicui, dentibus multis, annuli inferiores <1 mm, annuli superiores 1-2 mm usque ad 4 mm longos. Cataphyllae argenteae-albae, brunneolae ad apicem. Folia 3-4.7-8, grisea-virida, 1.5 mm diameter, glabra, (1)2 costis in omni sulco in folio inferiore. Folia bene evoluta ad anthesim, interdum inferiora, interdum flores superantia. Faux saturate flava, glabra. Perianthii tubus albescens usque ad violaceum prope segmenta, sine striis. Segmenta exteriora 21-35 mm, plerumque 26 mm longa (n = 34), 8-14 mm, plerumque 10 mm lata (n = 34). Segmenta interiora 20-32 mm, plerumque 25 mm longa, 7-15 mm, plerumque 10 mm lata (n = 34). Segmenta exteriora et interiora intus alba. Latera exteriora segmentorum exteriorum alba, grave pinnatinervia violacea. Latera exteriora segmentorum interiorum alba, vel alba cum macula parva brunnea versus perianthii tubum. Prophyllum abest. Bractea et bracteola adsunt, argentea, recutita, conspicua. Filamenta 3-5.3-7 mm longa (n = 34), saturate lutea, glabra. Antherae angustae sagittatae, acutatae vel rotundatae ad apicem, plerumque nigrae, praecipue versus apicem, raro luteae, 7-10.5-15 mm longae (n = 34). Connectivum nigrum, interdum luteolum versus basem, pollen luteum. Stylus aurantiacus, divisus in ramos tres, glabrus, rami 4-6.5-9 mm longi (n = 22). Stigma antheris brevior vel aequalis 82%, longior 18% (n = 34). Capsula et semina non visa. Chromosomatorum somaticorum numerus 12.

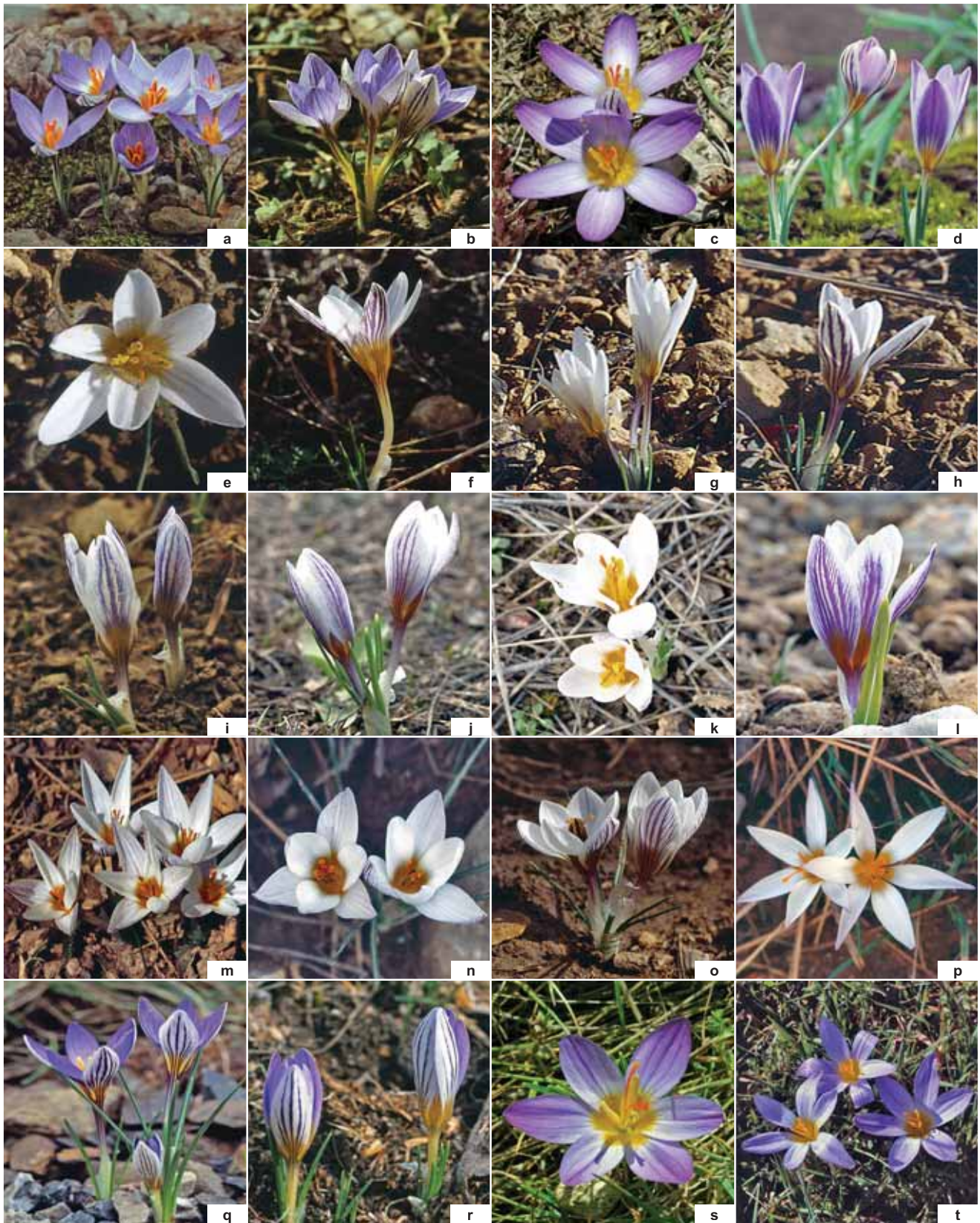


Fig. 1: Photographs of *Crocus mawii* (a-d), *Crocus karamanensis* (e-h), *Crocus abraeteolus* (i-l), *Crocus antherotes* (m-p), and *Crocus tahtaliensis* (q-t) from type locality.

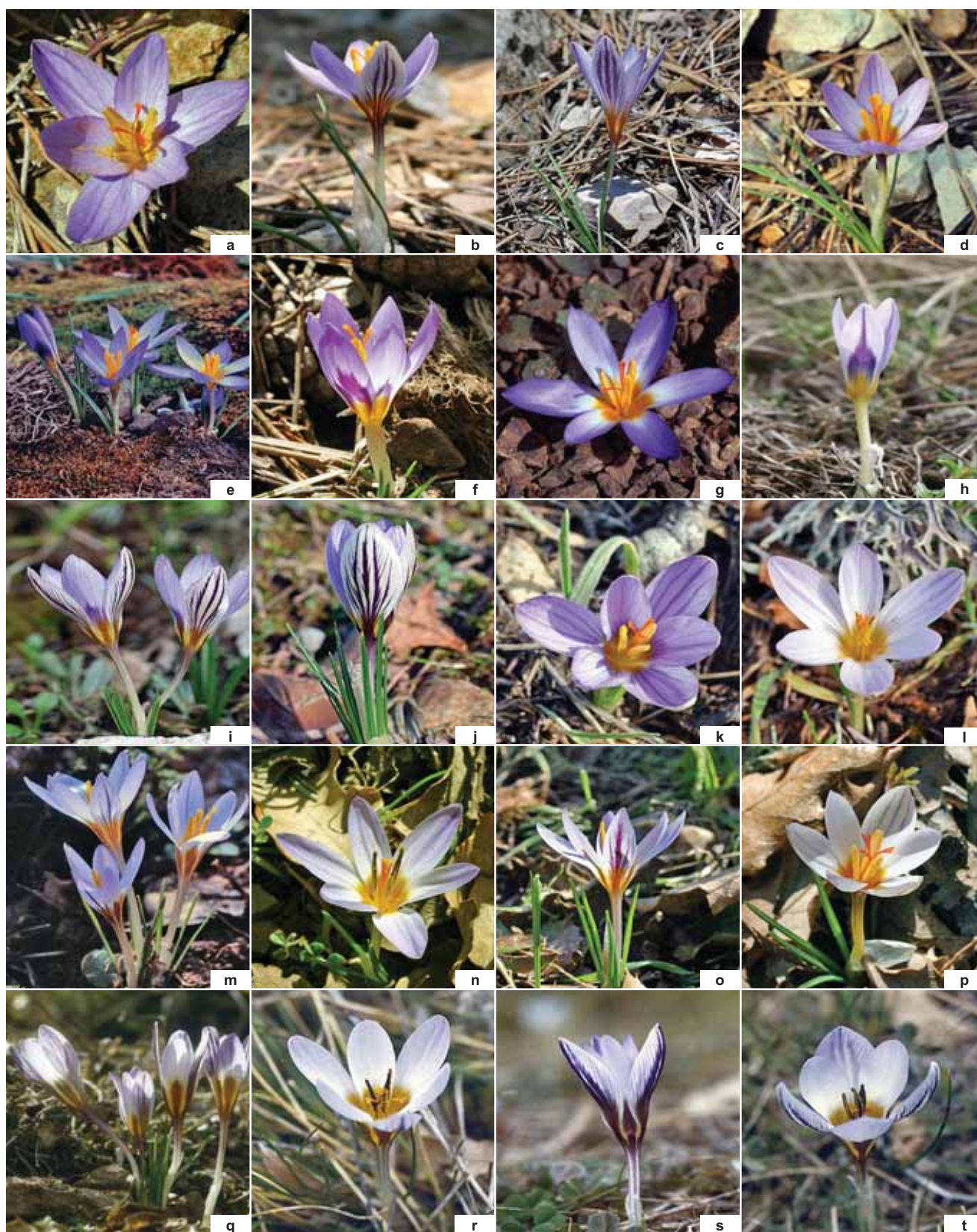


Fig. 2: Photographs of *Crocus mediotauricus* (a-d), *Crocus arizelus* (e-h), *Crocus calanthus* (i-l), *Crocus lyciotauricus* (m-p), and *Crocus ziyareten-sis* (q-t) from type locality.

Corm large, 20–22 mm in diameter, outer and tunics coriaceous, neck conspicuous, 8–12 mm long, consistent of broadly-based triangles abruptly changing into acute, long narrow fibres; tunics split into 2–5 mm long segments, sub-splits rare, instead many notches <1 mm exist; rings present, coriaceous and conspicuous, teeth many, on lower rings <1 mm on upper rings 1–2 mm but up to 4 mm long. Cataphylls silvery-white, brownish at apex. Leaves 3–4.7–8, greyish-green, 1.5 mm in diameter, glabrous, white stripe <1/3 to > 1/3 of leaf-diameter, (1)2 ribs underneath. Leaves at anthesis well developed, sometimes below, sometimes above flowers. Throat deep yellow, glabrous. Perianth tube whitish to violet near segments, without stripes. Outer segments between 21 and 35 mm but usually 26 mm long (n = 34), between 8 and 14 mm but usually 10 mm wide (n = 34). Inner segments between 20 and 32 mm but usually 25 mm long, between 7 and 15 mm but usually 10 mm wide (n = 34). Inside all segments are plain white. Outside of outer segments is white, heavily feathered violet. Outside of inner segments is white or white with a small brown spot towards the perianth tube (Fig. 1m–p). Prophyll absent. Bract and bracteole present, silvery, skinny, conspicuous. Length of filaments 3–5.3–7 mm (n = 34), deep yellow, no hair. Anthers narrowly arrow-shaped, acute or rounded at apex, mostly black, especially towards the tips, rarely yellow, 7–10.5–15 mm long (n = 34). Connective black, occasionally yellowish towards the lower part, pollen yellow. Styles orange, divided into 3 glabrous branches, 4–6.5–9 mm long (n = 22). Style length according to stamen is 82% shorter to equal, 18% longer (n = 34). Capsule and seeds not seen. Chromosome number 2n = 12.

According to molecular analyses *C. antherotes* is closely related to *C. fauseri*, *C. caricus* (HKEP 0307), *C. incognitus* and *C. mersinensis*.

Distribution and habitat. *C. antherotes* (= having a conspicuous flower) is until now only known from the type locality in the Madranbaba Mountains of Muğla Province. The plant grows on calcareous rocks together with *Daphne oleoides*, *Pteridium aquilinum*, *Doronicum*, *Gagea*, *Verbascum*, *Galanthus*, *Ornithogalum*, *Digitalis*, *Sedum*, *Scilla bifolia*, *Colchicum atticum*, *Crocus gargaricus*, thistles etc.

Crocus mawii, *C. karamanensis*, *C. abraeteolus* and *C. antherotes* are closely related according to molecular analysis. Other taxa, belonging to this group are, e.g., *C. chrysanthus* (HKEP1110, HKEP1116), *C. fauseri*, *C. mersinensis*, *C. tauricus* TRAUTV. from Crimea Peninsula, and *C. taseliensis*.

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

Holotypus: Turkey, Lycian Taurus, Antalya Province, Tahtalı Dağı 1400–1500 m, 13.3.1997, HKEP 9716 (Gatersleben, GAT 7446).

Cormus subglobosus, 15 mm in diameter, tunicae exteriores membranaceae, raro incrassatae, tunicae interiores membranaceae, collum brevissimum, minus quam 3 mm longum, constans ex triangulis compactis et latis; fissura segmentorum in fascies < 2 mm vel minor, sine subfissuris, annulis membranaceis cum margine integra vel leviter divaricata, dentes absunt. Cataphyllae argenteae-albae. Folia 3–4.4–7, atrovirida, 2.5–3 mm diameter,

glabra, 2 costis in omni sulco in folio inferiore. Folia plerumque breviora quam flores ad anthesim. Faux saturate lutea, glabra. Perianthii tubus albus, raro cum striis dilute griseis-violaceis versus apicem. Segmenta externa 21–36 mm, plerumque 27 mm longa (n = 35), 5–14 mm, plerumque 7 mm lata (n = 35). Segmenta interna 19–31 mm, plerumque 26 mm longa, 5–17 mm, plerumque 8 mm lata (n = 35). Segmenta omnia dilute usque ad saturate violacea, dilute venosa fusca. Segmenta externa aut dilute violacea-caerulea aut albescentia usque ad bubalina venosa pauca verticalia violacea. Segmenta interna extus plerumque dilute usque ad saturate violacea cum striis griseis ad basim. Prophyllum abest. Bractea et bracteola argentea, scariosa, inconspicua. Filamenta 5–6.7–8 mm (n = 35), lutea, glabra. Antherae angustae, non distinctae sagittatae, sine acumine ad basim, complanatae ad apicem, luteae, 8–10.3–16 mm longae (n = 35). Connectivum latissimum et distinctum, incoloratum. Pollen flavum. Stylus aurantiacus, divisus in ramos tres, glabrus, rami stigmatici 4–7–11 mm longi (n = 8). Longitudo stylorum brevior vel aequalis 81%, longior 19% quam antherae (n = 36). Capsula et semina non visa. Chromosomatorum somaticorum numerus 10.

Corm spherical, 15 mm in diameter, outer tunics membranous, rarely thicker, the inner ones membranous, neck very short, less than 3 mm long, consistent of rather compact and broad triangles; tunics split into bands of 2 mm or less, no sub-splits, rings membranous entire-edged or slightly pronged, no teeth. Cataphylls silvery-white. Leaves 3–4.4–7, dark green, 2.5–3 mm in diameter, glabrous, white stripe prominent, 1/3 – 1/2 of leaf-diameter, 2 ribs underneath. Leaves at anthesis mostly shorter than flowers. Throat deep yellow, no hair. Perianth tube white, rarely striped light greyish-violet near the apex. Outer segments between 21 and 36 mm but usually 27 mm long (n = 35), between 5 and 14 mm but usually 7 mm wide (n = 35). Inner segments between 19 and 31 mm but usually 26 mm long, between 5 and 17 mm but usually 8 mm wide (n = 35). Inside all segments are light to deep violet, thinly veined darker. Outer segments are either light violet-blue or whitish to buff-coloured with few violet mainly vertically orientated stripes (Fig. 1q, r). Outside of inner segments mostly light to deep violet with soft greyish stripes near the perianth tube. Prophyll absent. Bract and bracteole present, silvery, skinny, inconspicuous. Length of filaments 5–6.7–8 mm (n = 35), yellow, no hair. Anthers narrow, not distinctly arrow-shaped, almost no peaks at the lower ends, flattened at top, yellow, 8–10.3–16 mm long (n = 35). Connective very broad and distinct, colourless. Pollen yellow. Styles orange, divided into 3 glabrous branches, 4–7–11 mm long (n = 8). Style length according to stamen is in 81% shorter to equal, in 19% longer (n = 36). Capsule and seeds not seen. Chromosome number 2n = 10.

Distribution and habitat. *C. tahtaliensis* is most probably confined to the Tahtalı Dağı in east Lycia, Antalya Province. The plant grows in forest openings and meadows, only on calcareous rocks together with *Galanthus elwesii*, *Anemone blanda*, *Scilla bifolia*, *Crocus minutus*, *Colchicum sanguicolle* etc.

6. *Crocus mediotauricus* KERNDORFF & PASCHE, species nova

Holotypus: Turkey, Pisidian Taurus, Antalya Province, Geyik Dağları, 1600–1900 m, 18.3.2001, HKEP 0112 (Gatersleben, GAT 7247).

Cormus globosus, 12–18 mm diameter; tunicae exteriores coriaceae usque ad membranaceas, tunicae interiores membranaceae, collum 3–5 cm longum, constans ex comparate latis et minus maioribus triangulis acutis, fissura segmentorum in segmenta < 2 mm, sine subfissura, annuli bene evoluti, multi, coriacei usque ad membranaceos, duriores divaricati manifeste significatis dentibus, multi dentes, sed minus quam 1 mm, molliores sine dentibus, margine pleno vel divaricata diluta. Cataphyllae argenteae-albae usque ad luteolas. Folia 3–4.8–7, virida, 1–1.5 mm diameter, glabra, (1)2 costis in omni sulco in folio inferiore. Folia breviora quam flores sub anthesi. Corolla fauce saturate lutea, usque ad aurantiacam, glabra. Perianthii tubus albus, striatus, saturate brunneus usque ad violaceum ad apicem. Segmenta externa 20–41 mm, plerumque 30 mm longa (n = 33), 6–15 mm, plerumque 11 mm lata (n = 33). Segmenta interna 19–39 mm, plerumque 29 mm longa, 7–15, plerumque 10 mm lata (n = 33). Segmenta omnia dilute usque ad intense violaceum-caeruleum cum nervatura molli et magis fusca vel pinnatinervia prominenti. Segmenta externa extus alba usque ad bubalina, plus minusve striata et venosa intense verticalia. Segmenta interna extus lilacina-caerulea, interdum dilute venosa magis fusca. Prophyllum abest. Bractea et bracteola adsunt, argentea, scariosa, interdum conspicua. Filamenta 2–4.6–6 mm longa (n = 33), saturate lutea usque ad aurantiaca, glabra. Antherae indistinctae sagittatae, luteae usque ad griseae-nigrae, 9–10.9–15 mm longae (n = 33). Connectivum sine colore, prominens, pollen luteum. Stylus aurantiacus, divisus in ramos tres, leviter expansus ad apicem; rami stigmatici 4–6.3–9 mm longi (n = 21). Stigma antheris brevior usque ad aequaliam 64%, longiorem 36% (n = 33). Capsula ovoidea cum spina ad apicem, 17 mm longa. Semina castanacea, cum raphe indistincta et caruncula prominenti. Chromosomatorum somaticorum numerus 10.

Corm 12–18 mm in diameter, globose; outer tunics coriaceous to membranous, the inner ones membranous, neck 3–5 mm long, consistent of relatively broad, medium-sized pointed triangles; splits of tunics into bands of < 2 mm, no sub-splits, rings well developed, many, coriaceous to membranous, the harder ones pronged or significantly toothed, teeth many but less than 1 mm long, softer ones without teeth, whole-edged or slightly pronged. Cataphylls silvery-white to yellowish. Leaves 3–4.8–7, green, 1–1.5 mm in diameter, glabrous, white stripe <1/3 of leaf-diameter, (1)2 ribs underneath. Leaves at anthesis poorly developed, never reaching the basis of flowers. Throat deep yellow to orange, glabrous. Perianth tube white striped dark-brown to violet near the apex. Outer segments between 20 and 41 mm but usually 30 mm long (n = 33), between 6 and 15 mm but usually 11 mm wide (n = 33). Inner segments between 19 and 39 mm but usually 29 mm long, between 7 and 15 mm but usually 10 mm wide (n = 33). Inside all segments are light to intense violet-blue with darker veins or prominent featherings (Fig. 2a, d). Outside of outer segments is white to buff-coloured with more or less intense vertical striping and veining (Fig. 2b, c). Outside of inner segments is plain lilac-blue occasionally with faint darker veins. Prophyll absent. Bract and bracteole present, silvery, skinny, sometimes conspicuous (Fig. 2b, c). Length of filaments 2–4.6–6 mm (n = 33), deep yellow to orange, no hair. Anthers indistinctly arrow-shaped, varying from yellow to greyish-black even in single individuals, 9–10.9–15 mm long (n = 33). Connective colourless, prominent, pollen yellow. Style orange, divided into 3 branches, which are slightly expanded at the apex; branches 4–6.3–9 mm long (n = 21). Style length

according to stamen is 64% shorter to equal and 36% longer (n = 33). Capsule extended ovoid with a spine on top, 17 mm long. Seeds chestnut-brown, rather shiny, having an indistinct raphe but a prominent caruncle. Chromosome number 2n = 10.

Distribution and habitat. *C. mediotauricus* is a high alpine plant and grows obviously only on calcareous rocks high up in the middle Taurus mountains. Until now it is only known from the type locality in the Geyik Mountains in Antalya Province. The plant grows together with *Abies cilicica*, *Cedrus libani*, *Juniperus*, *Digitalis*, *Muscari*, thistles, grasses etc.

7. *Crocus arizelus* KERNDORFF & PASCHE, species nova

Holotypus: Turkey, Caria, Muğla Province, Gölgeli Dağları, 1300–1600 m, 16.3.2004, HKEP 0403 (Gatersleben, GAT 7153).

Corm 12–15 mm diameter, tunicae externae coriaceae usque ad membranaceas, tunicae interiores membranaceae; collum brevissimum, 2–3 mm longum, constans ex triangulis latis non prolongatis, saepe findens tunicas in segmentis 2–5 mm; annuli adsunt, membranacei, breves et angusti sine dentibus. Cataphyllae argenteae-albae. Folia 3–4.3–6, virida, 1.5 mm diameter, glabra, (1)2 costis in omni sulco in folio inferiore. Folia plerumque hystantha ad anthesin. Corolla fauce saturate flava, usque ad aurantiaca, glabra. Perianthii tubus albus, brunneolus-violaceus ad apicem. Segmenta exteriora 17–32 mm, plerumque 25 mm longa (n = 33), 6–12 mm, plerumque 9 mm lata (n = 33). Segmenta exteriora 17–30 mm, plerumque 23 mm longa, 6–10 mm, plerumque 8 mm lata (n = 33). Segmenta exteriora et interiora intus dilute caerulea-violacea sine maculis, color intense crescens versus apicem segmentorum ab fere albo in centro florum usque ad dilute caeruleum-violaceum ad apicem, praecipue segmenta exteriora. Latera externa segmentorum exteriorum violacea-caerulea sine striis, saepe cum macula distincta cingens faucem luteam. Latera exteriora segmentorum exteriorum similia, sed generaliter pallidiora. Prophyllum abest. Bractea et bracteola adsunt, argentea, recutita, conspicua. Filamenta 3–4.9–8 mm longa (n = 33), 6–12 mm, plerumque 9 mm lata (n = 33). Segmenta interiora 17–30 mm, plerumque 23 mm longa, 6–10 mm, plerumque 8 mm lata (n = 33). Connectivum latum, sine colore; pollen flavum. Stylus aurantiacus usque ad aurantiacum-rubrum, divisus in ramos tres plus minusve 5.5 mm, (amplitudo plus minusve 4–7 mm), scabridus, leviter expansus vel fimbriatus ad apicem (n = 33). Stigma antheris longior vel aequalis 91%, 9% brevior (n = 33). Capsula et semina non visa. Chromosomatorum somaticorum numerus 10.

Corm 12–15 mm in diameter, outer tunics coriaceous to membranous, the inner ones membranous; neck very short, 2–3 mm long, consistent of broadly based but not prolonged triangles; tunics split frequently into segments of 2–5 mm, very rarely thin sub-splits of less than 0.5 mm, rings present, membranous, small and narrow, more or less whole-edged, no teeth. Cataphylls silvery-white. Leaves 3–4.3–6, green, 1.5 mm in diameter, glabrous, white stripe 1/3 of leaf-diameter, (1)2 ribs underneath. Leaves at anthesis in most cases not present, rarely visible tips above ground. Throat deep yellow to orange, no hair. Perianth tube white, brownish-violet near segments. Outer segments between 17 and 32 mm but usually 25 mm long (n = 33), between 6 and 12 mm but usually 9 mm wide (n = 33). Inner segments between 17 and 30 mm but usually



Fig. 3: Photographs of *Crocus oreogenus* (a-d), *Crocus multicostatus* (e-h), *Crocus incognitus* (i-j), *Crocus colereus* (k-n) from type locality.

23 mm long, between 6 and 10 mm but usually 8 mm wide (n = 33). Inside all segments are deep bluish violet without markings, the colour intensity increases towards the peak of the segments from nearly white in the centre of the flower to bluish-violet at the peaks; this is especially true for the outer segments (Fig. 2g). Outside of outer segments is plain violet-blue without striping or feathering but frequently with a very significant violet spot often surrounding the yellow of the throat when shining through (Fig. 2f, h). Outside of inner segments similar to the outer ones but in general paler. Prophyll absent. Bract and bracteole present, silvery, skinny, conspicuous. Filaments 3-4.9-8 mm long (n = 33), deep yellow to orange, no hair. Anthers broadly arrow-shaped but flattened at top, yellow (Fig. 2e, g), 7-9.5-12 mm long (n = 33). Connective broad, colourless; pollen yellow. Styles orange to orange-red, divided into 3 branches of an average length of 5.5 mm (range 4-7 mm), scabrid, only slightly expanded or fringed at the apex, (n = 33). Style length according to stamen in 91% longer to equal, 9% shorter (n = 33). Capsules and seeds not seen. Chromosome number 2n = 10.

Distribution and habitat. Until now *C. arizelus* (= remarkable, conspicuous) is known only from the type locality in the Gölgeli Mountains in Muğla Province. The plant grows together with *Pinus nigra* subsp. *pallasiana*, *Styrax officinalis*, *Quercus coccifera*, *Petridium aquilinum*, *Cyclamen alpinum*, *Scilla bifolia*, *Euphorbia*, *Verbascum*, *Juniperus*, *Berberis*, *Crocus fleischeri*, *Crocus danfordiae*, *Alyssum* etc.

8. *Crocus calanthus* KERNDORFF & PASCHE, species nova

H o l o t y p u s: Turkey, Lycian Taurus, Antalya Province, Ak Dağlar 1200-1400 m, 9.3.2001, HKEP 0123 (Gatersleben, GAT 7149).

Cormus ca. 15 mm diameter, tunicae exteriores coriaceae, interiores molles non membranaceae, collum brevissimum, 2-4 mm longum, cum triangulis latis ad basim; tunica fissa in segmenta lata >5 mm, annuli adsunt, dentes absunt. Cataphyllae argenteae-albae. Folia 4-6.2-10, saturate virida, 1-2 mm diameter, glabra, 2(3) costis in omni sulco in folio inferiore. Folia bene evoluta ad anthesim, attingentia vel superantia flores. Faux lutea, glabra. Perianthii tubus albus, brunneolus-violaceus vel striatus brunneolus versus apicem. Segmenta externa 26-48 mm, plerumque 32 mm longa (n = 34), 8-20 mm, plerumque 12 mm lata (n = 32). Segmenta interna 26-42 mm, plerumque 31 mm longa, 6-18 mm, plerumque 11 mm lata (n = 32). Segmenta omnia intus lilacina-caerulea usque ad saturate violacea-caerulea, saepe venosa clara violacea et subtiliter pinnatinervia. Latera segmentorum exteriorum alba usque ad bubalina, evidenter striata et pinnatinervia violacea. Latera exteriora segmentorum interiorum caerulea-violacea cum macula violacea ad basim, brunnescens versus perianthii tubum. Prophyllum abest. Bractea et bracteola adsunt, argentea, recutita, plerumque conspicua. Filamenta 6-7.6-10 mm longa (n = 32), lutea, glabra. Antherae sagittatae, saepe rotundatae ad apicem, luteae, 8-11.2-16 mm longae (n = 32). Connectivum album, raro subnigrum in superiore tertia parte, pollen flavum. Stylus aurantiacus, divisus in ramos tres, expansus buccinatus et fimbriatus ad apicem, rami stigmatici 4-6.3-9 mm longi (n = 32). Stigma antheris longior usque ad aequalem

71%, brevior 29% (n = 32). Capsula obovata, ca. 2 cm longa, semina saturate brunnea, magna, 4-5 mm longa, 2 mm lata cum raphe indistincta et caruncula prominenti. Chromosomatorum somaticorum numerus 12.

Corm about 15 mm in diameter, outer tunics coriaceous, the inner ones softer but not membranous, neck very short 2-4 mm long, consistent of basically broad triangles not significantly prolonged; splits of tunics into broad segments of >5 mm, no sub-splits, rings present, more or less whole-edged, rather smooth not coriaceous, no teeth. Cataphylls silvery-white. Leaves 4-6.2-10, deep green, 1-2 mm in diameter, glabrous, white stripe >1/3 of leaf-diameter, 2(3) ribs underneath. Leaves at anthesis well developed, reaching or overtopping the flowers. Throat yellow, no hair. Perianth tube white, brownish-violet or brownish striped towards the apex. Outer segments between 26 and 48 mm but usually 32 mm long (n = 34), between 8 and 20 mm but usually 12 mm wide (n = 32). Inner segments between 26 and 42 mm but usually 31 mm long, between 6 and 18 mm but usually 11 mm wide (n = 32). Inside all segments are lilac-blue to deep violet-blue often with pronounced violet veins and finer featherings (Fig. 2k). Outside of outer segments white to buff-coloured heavily striped and feathered violet (Fig. 2i, j). Outside of inner segments plain bluish-violet with a violet spot at basis becoming brown towards the perianth tube. Prophyll absent. Bract and bracteole present, silvery, skinny, mostly conspicuous. Length of filaments 6-7.6-10 mm (n = 32), yellow, no hair. Anthers arrow-shaped but often rounded at top, yellow, 8-11.2-16 mm long (n = 32). Connective white, rarely blackish in the upper third, pollen yellow. Style orange, divided into 3 branches, often expanded, trumpet-shaped and fringed at the apex, branches 4-6.3-9 mm long (n = 32). Style length according to stamen is 71% longer to equal, 29% shorter (n = 32). Capsule obovate around 2 cm long, seeds dark brown, large, 4-5 mm long and 2 mm broad with an indistinct raphe but a prominent caruncle. Chromosome number 2n = 12.

Distribution and habitat. *C. calanthus* (= nice flowering) is a beautiful large but obviously very rare crocus, until now only known from the rather remote type locality in the White Mountains in Antalya Province. The plant grows on calcareous rocks together with *Cedrus libani*, *Quercus*, *Daphne gnidioides*, *Phlomis*, *Ornithogalum*, *Galanthus elwesii*, *Lamium*, *Veronica*, grasses etc.

In molecular analyses *C. arizellus*, *C. mediotauricus*, *C. tahtaliensis*, and *C. calanthus* are closely related taxa.

9. *Crocus lyciotauricus* KERNDORFF & PASCHE, species nova

H o l o t y p u s: Turkey, Lycian Taurus, Antalya Province, southern coastal mountains, 1000-1200 m, 8.3.1998, HKEP 9804 (Gatersleben, GAT 7193).

Cormus subglobosus, 14-18 mm diameter, tunicae exteriores coriaceae usque ad membranaceas, tunicae interiores membranaceae, collum breve, 3-5 mm longum, constans ex triangulis asperis clare elongatis, formans collum setosum; Tunica separata in segmenta pauca, lata (>5 mm), sine subfissuris, annuli adsunt, membranacei, sine dentibus. Cataphyllae argenteae-albae. Folia 3-4.6-10, virida, 2 mm

diameter, glabra, folia nervis utroque costae latere (1)2. Folia plerumque breviora quam flores sub anthesi. Faux saturate lutea usque ad aurantiaca, glabra. Perianthii tubus albus, cum striis magis fuscis ad apicem. Segmenta externa 19-30 mm, plerumque 25 mm longa (n = 37), 6-13 mm, plerumque 9 mm lata (n = 37). Segmenta interna 18-29 mm, plerumque 23 mm longa, 6-13 mm, plerumque 9 mm lata (n = 37). Segmenta omnia intus alba usque ad dilute lilacina-caerulea sine nervatura. Segmenta externa extus alba, non bubalina colorata, plus minusve striata, pinnatinervia vel punctata violacea. Segmenta interna plane colorata alba usque ad dilute lilacina-caerulea sine nervatura, solum venae lateris externi aspectabiles. Latera externa segmentorum exteriorum alba, non bubalina, plus minusve striata, pinnatinervia vel punctata violacea. Segmenta interna plane colorata sine nervatura, inter album et dilute lilacinum, cum macula saturate brunnea versus tubum perianthii. Prophyllum abest. Bractea et bracteola adsunt, argentea, scariosa, raro conspicua. Filamenta 6-6.8-8 mm longa (n = 37), lutea usque ad aurantiaca, glabra. Antherae anguste sagittatae, raro solum luteae, plerumque griseae-viridae vel subnigrae, praecipue versus apicem, 8-10.1-12 mm longae (n = 37), connectivum prominens, raro solum album, plerumque album ad basim, futurum griseum, viridescens vel nigrescens ab medio versus apicem; pollen luteum. Stylus aurantiacus usque ad aurantiacum-rubrum, divisus in ramos tres, parvus usque ad clarum expansum stylum ad apicem, rami stigmatici 4-7.1-10 mm longi (n = 16). Stigma antheris longiora vel aequalis 92%, brevior 8% (n = 37). Capsula et semina non visa. Chromosomatorum somaticorum numerus 10.

Corm subglobose, 14-18 mm in diameter, outer tunics coriaceous to membranous, the inner ones membranous, neck short, 3-5 mm long, consistent of coarse triangles but significantly elongated which makes the neck bristly; tunics split into few broad segments (>5 mm), no sub-splits, rings present, membranous, large but narrow, whole-edged or indistinctly pronged, no teeth. Cataphylls silvery-white. Leaves 3-4.6-7, green, 2 mm in diameter, glabrous, white stripe 1/3 of leaf-diameter, 1(2) ribs underneath. Leaves at anthesis mostly shorter than flowers. Throat deep yellow to orange, no hair. Perianth tube white with darker stripes near the apex. Outer segments between 19 and 30 mm but usually 25 mm long (n = 37), between 6 and 13 mm but usually 9 mm wide (n = 37). Inner segments between 18 and 29 mm but usually 23 mm long, between 6 and 13 mm but usually 9 mm wide (n = 37). Inside all segments are white to pale lilac-blue without veins. Only veins from the outer tissue-layer are shining through. Outside of outer segments white, not buff-coloured, more or less striped, feathered or speckled violet (Fig. 2m, o). Inner segments plain coloured without veins, between white and pale lilac with a dark brown spot towards the perianth tube. Prophyll absent. Bract and bracteole present, silvery, skinny, rarely conspicuous. Length of filaments 6-6.8-8 mm (n = 37), yellow to orange, no hair. Anthers narrowly arrow-shaped, rarely only yellow, mostly greyish-green or blackish, especially towards the top, 8-10.1-12 mm long (n = 37). Connective prominent, rarely only white, mostly white at base becoming greyish, greenish or blackish from the middle towards the apex; pollen yellow. Style orange to orange-red, divided into 3 branches, sometimes with subdivisions, little to significantly expanded at the apex, branches 4-7.1-10 mm long (n = 16). Style length according to stamen is 92% longer to equal, 8% shorter (n = 37). Capsule and seeds not seen. Chromosome number 2n = 10.

Distribution and habitat. Until now *C. lyciatauricus* is only known from the type locality and in some Lycian coastal mountains in Antalya Province. The plant grows together with *Quercus coccifera*, *Cedrus libani*, *Crocus lycius*, *Iris*, *Colchicum szovitsii*, *Ilex colchica*, *Cyclamen graecum* etc.

10. *Crocus ziyaretensis* KERNDORFF & PASCHE, species nova

Holotypus: Turkey, Lycian Taurus, Antalya Province, Ziyaret Dağları 1300-1600 m, 13.3.1998, HKEP 9820 (Gatersleben GAT 23080)

Cormus 15-16 mm diameter, tunicae exteriores coriaceae, interiores molles, non membranaceae, collum 4-5 mm longum, constans ex triangulis latis, tenues et elongati abrupte in acumine, facientes collum setosum; segmenta tunicarum lata, >5 mm, sine subdivisionibus, annuli adsunt, coriacei usque ad membranaceos, dentes absunt. Cataphyllae argenteae-albae. Folia 3-4.4-7, virida, 1.5 mm diameter, glabra, 2 costis in omni sulco in folio inferiore. Folia evoluta infirma ad anthesim, numquam attingens flores. Faux saturate lutea, glabra. Perianthii tubus albus, intense striatus brunneolus-violaceus versus apicem. Segmenta exteriora 16-29 mm, plerumque 23 mm longa (n = 32). Segmenta interna 14-27 mm, plerumque 21 mm longa, 3-11 mm, plerumque 8 mm lata (n = 32). Intus segmenta ex toto alba usque ad pallide lilacina-caerulea sine striis vel nervaturis. Segmenta externa extus dilute lilacina-caerulea, plerumque maxima pars intense striata vel pinnatinervia. Latera externa segmentorum interiorum alba usque ad lenia lilacea-caerulea, cum macula brunnea ad basim segmentorum. Bractea et bracteola adsunt, argentea, recutita, inconspicua. Filamenta 5-6.9-9 mm longa (n = 32), lutea, glabra. Antherae angustae sagittatae, nigrae, 5-9.1-13 mm longae (n = 32). Connectivum nigrum; pollen flavum. Stylus aurantiacus, divisus in ramos tres, saepe expansum ad apicem, rami stigmatici 4-5.3-8 mm longae (n = 15). Stigma antheris brevior usque ad aequalem 97%, longior 3% (n = 32). Capsula ovoidea acuta ad apicem, 15 mm longa. Semina 3-4 mm longa, violacea brunnea, raphe inconspicua et caruncula prominens. Chromosomatorum somaticorum numerus 10.

Corm 15-16 mm in diameter, outer tunics coriaceous, the inner ones softer but not membranous, neck 4-5 mm long, consistent of broadly based triangles which are thinned and elongated abruptly into an acute peak forming a bristly neck; splits of tunics broad, > 5 mm, no sub-splits, rings present, coriaceous to membranous, whole-edged, no teeth. Cataphylls silvery-white. Leaves 3-4.4-7, green, 1.5 mm in diameter, glabrous, white stripe 1/3 of leaf-diameter, 2 ribs underneath. Leaves at anthesis poorly developed never reaching the flower. Throat deep yellow, glabrous. Perianth tube white, intensely striped brownish-violet towards apex. Outer segments between 16 and 29 mm but usually 23 mm long (n = 32), between 5 and 11 mm but usually 7 mm wide (n = 32). Inner segments between 14 and 27 mm but usually 21 mm long, between 3 and 11 mm but usually 8 mm wide (n = 32). Inside all segments are white to pale lilac-blue without stripes or veins. Outsides of outer segments are light lilac-blue with mostly intense stripes or featherings (Fig. 2q, s). Outsides of inner segments are white to very soft lilac-blue with a deep brown spot near the basis of segments. Prophyll absent. Bract and bracteole present, silvery, skinny, inconspicuous. Length of filaments 5-6.9-9 mm (n = 32),

yellow, no hair. Anthers narrow, acutely arrow-shaped, black, 5-9.1-13 mm long (n = 32). Connective black; pollen yellow. Style orange, divided into 3 branches, often expanded at the apex, branches 4-5.3-8 mm long (n = 15). Style length according to stamen is 97% shorter to equal, 3% longer (n = 32). Capsule ovoid acute at top, 15 mm long. Seeds 3-4 mm long, violet-brown with an inconspicuous raphe and a prominent caruncle. Chromosome number 2n = 10.

Distribution and habitat. *C. ziyaretensis* has obviously a rather restricted distribution area and is until now only known from the type locality in the central Ziyaret Mountains of Antalya Province. The plant grows on calcareous soils together with *Quercus*, *Juniperus*, *Astragalus*, *Crocus cancellatus*, *Crocus fleischeri* etc.

11. *Crocus oreogenus* KERNDORFF & PASCHE, species nova

Holotypus: Turkey, Lycian Taurus, Bey Dağları, 1500-1800 m, 12.3.2001, HKEP 0126 (Gatersleben, GAT 7127).

Cormus 10-12 mm diameter, tunicae exteriores coriaceae usque ad membranaceas, collum breve, 2-3 mm longum, constans ex triangulis grossis, minute prolongatis ad apicem; fissura tunicarum 2-5 mm, raro subfissurae <1 mm; annuli adsunt, membranacei, angusti vel potius lati (2 mm), integri marginati vel divaricati, nullis dentibus. Cataphyllae argenteae-albae. Folia 3-5.2-8, virida, 1-2 mm diameter, glabra, 2(3) costis in omni sulco in folio inferiore. Folia aliter evoluta ad florentia. Interdum non visibilia, interdum superantia flores. Faux citrina usque ad saturate luteam, distinctissima et extensa in dimidio floris, perveniens partem gracilem species huius, glabra. Perianthii tubus albus usque ad luteolum, dilute violaceus versus segmenta. Segmenta exteriora 17-34 mm, plerumque 26 mm longa (n = 38), 3-14 mm, plerumque 9 mm lata (n = 38). Segmenta interiora 15-33 mm, plerumque 8 mm lata (n = 38). Segmenta interiora et exteriora intus pallide lilacina-caerulea, sine macula significata. Latera exteriora segmentorum exteriorum in dimidio superno generaliter sine macula, medium infernum descriptum zona significata atra-caerulea-violacea zona, colore flammeo ad margines superiores, interrupta in medio albis verticalibus linearibus maculis. Latera exteriora segmentorum interiorum comparate similia ad segmenta exteriora praeter colores pallidiores et maculae minus manifestae. Prophyllum abest. Bractea et bracteola adsunt, argentea, recutita, plerumque conspicua. Filamenta 4-6-8 mm longa (n = 30), saturate lutea usque ad aurantiaca, glabra. Antherae angustae sagittatae, complanatae ad apicem, luteae, 6-9.1-14 mm longae (n = 38). Connectivum pallide flavum, pollen flavum. Stylus aurantiacus-rubrus, divisus in ramos tres, saepe buccinatus ad apicem, rami 4-5.8-9 mm longi (n = 26). Styli antheris breviores vel aequilongi 82%, longiores 18% (n = 38). Capsula non visa. Semina subglobosa usque ad ovata, 3 mm longa, saturate brunnea cum testa aspera. Raphe indistincta, caruncula bene evoluta. Chromosomatorum somaticorum numerus 10.

Corm 10-12 mm in diameter, outer tunics coriaceous to membranous, the inner ones membranous, neck short, 2-3 mm long, consistent of coarse triangles minutely prolonged at top; splits of tunics of 2-5 mm, sub-splits rare, <1mm; rings present, membranous, narrow to rather broad (2 mm) more or

less whole-edged or pronged, no teeth. Cataphylls silvery-white. Leaves 3-5.2-8, green, 1-2 mm in diameter, glabrous, white stripe <1/3 of leaf-diameter, 2(3) ribs underneath. Leaves at anthesis very differently developed. In some cases even not visible in others overtopping the flower. Throat lemon-yellow to deep yellow, very distinct and extended to half of the flower, reaching the very prominent waist of this species, no hair. Perianth tube white to yellowish, light violet towards the segments. Outer segments between 17 and 34 mm but usually 26 mm long (n = 38), between 3 and 14 mm but usually 9 mm wide (n = 38). Inner segments between 15 and 33 mm but usually 24 mm long, between 5 and 12 mm but usually 8 mm wide (n = 38). Inside all segments are pale lilac-blue without any significant markings. Outside of outer segments is in the upper half generally without markings, the lower half is often characterised by a significant deep bluish-violet zone which is flamed at the upper edges and interrupted in the middle by white linear vertical spots, (Fig. 3a, b, c). The outside of the inner segments is comparatively similar to the one of the outer segments only colours are more pale and markings less pronounced. Prophyll absent. Bract and bracteole present, silvery, skinny, mostly conspicuous. Length of filaments 4-6-8 mm (n = 30), deep yellow to orange, no hair. Anthers narrowly arrow-shaped, flattened at top, yellow, 6-9.1-14 mm long (n = 38). Connective light yellow, pollen yellow. Style orange, rarely orange-red, divided into 3 branches which are frequently trumpet-shaped at the apex, branches 4-5.8-9 mm long (n = 26). Style length according to stamen is 82% shorter to equal, 18% longer (n = 38). Capsule not seen. Seeds subglobose to oval, 3 mm long, dark brown with a coarse testa. Raphe indistinct, caruncle well developed. Chromosome number 2n = 10.

Distribution and habitat. Until now *C. oreogenus* (= mountain-born) is only known from the type locality high up in the Bey Dağları in Antalya Province. The plant grows on calcareous ground together with *Salvia*, *Scilla bifolia*, *Anemone blanda*, *Tulipa*, *Euphorbia*, *Astragalus*, *Galanthus* etc.

Phylogenetic investigations revealed a close relationship between *C. oreogenus*, *C. lyciotauricus*, and *C. ziyaretensis*. Other relatives are *C. beydaglarensis* and several other species in Lycia.

12. *Crocus multicostatus* KERNDORFF & PASCHE, species nova

Holotypus: Turkey, Caria, Izmir Province, Boz Dağlar, 1200-1400 m, 20.3.2004, HKEP 0401 (Gatersleben, GAT 7379).

Cormus subglobosus, 1-2 cm diameter. Tunicae coriaceae, interiores molles. Annuli adsunt, coriacei cum dentibus significatis plerumque longitudibus alternis (1-5 mm). Collum 4-6 mm longum. Cataphyllae plerumque 3, argenteae-albae, rotundatae et late dilatatae, punctatae intense atrobrunneae ad apicem. Folia synantha, superans flores ad anthesim, 2-6, plus minusve 3.2 (n = 29), saturate virida, pars latior in medio, 2-3.5 mm diameter, glabra, interdum ciliata, multis costis in omni sulco in folio inferiore (3) 5 - 6 (n = 29). Faux saturate lutea, nonnumquam brunneola vel punctata dilute brunneola, raro cum fauce parvula violacea similis Croco ionopharyngi, glabra, sporadica scabra. Perianthii tubus saturate violaceus-brunneus ad apicem, deorsum dilutus. Segmenta exteriora 18-22

mm, plerumque 22 mm longa, 6-13 mm, plerumque 8 mm lata. Segmenta interiora 16-31 mm, plerumque 21 mm longa, 6-16 mm, saepe 9 mm lata. Segmenta exteriora et interiora intus alba sine macula, segmenta exteriora extus alba vel bubalina, intense striata brunnea-violacea super segmenta omnia. Prophyllum abest. Bractea et bracteola adsunt, recutita, argentea-alba, suffusa saturate brunnea aetate protracta ad apicem. Bractea angustior quam bracteola, generaliter eadem longitudine. Filamenta 5-12 mm, plus minusve 7.2 mm longa, lutea, brunneola ad basem vel brunneola tota; antherae nigrae, late sagittatae, rotundatae ad apicem, interdum cum incisura in medio, tenuissimae connectae ad filamenta, 6-13 mm plus minusve 9 mm longa, connectivum nigrum. Pollen flavum. Styli pellucidi aurantiaci, divisi in ramos tres, leviter expansi ad apicem; rami 5-9 mm, plerumque 6.7 mm longi, glabri. Stigma semper brevior usque ad aequalem (100%) comparata staminibus (n = 29). Capsula et semina non visa. Chromosomatorum somaticorum numerus 10.

Corm sub-globose, about 1-2 cm in diameter. Tunics coriaceous, the inner ones softer; main splits from neck down and basis up into segments broader than or equal to 2 mm. Sub-splits and notches very significant. They are of less than 0.5 mm, rather short and alternate with the longer main splits. Rings present and also coriaceous with significant teeth of mostly alternate length (1-5 mm). Neck of normal length, 4-6 mm long, built of relatively coarse triangles which are created by down-splits of the neck. Cataphylls mainly 3, silvery-white, rounded and broadly widened, speckled intensely dark brown at the apex. Leaves synanthous longer as flowers at anthesis, 2-6 but in average 3.2 (n = 29), dark green, broadest part in the middle, 2-3.5 mm in diameter, glabrous, sometimes ciliated, very many ribs underneath on both sides of the blade (3) 5 – 6 (n = 29). White stripe normal, 1/3 of leaf diameter. Throat deep yellow occasionally brownish towards perianth tube (Fig. 3f) infrequently also with a deeper, small violet throat, similar to the one of *C. ionopharynx*, glabrous, sporadically rough. Perianth tube deep violet-brown near apex, further down lighter. Outer segments between 18 and 22 mm but usually 22 mm long, between 6 and 13 mm, mostly 8 mm wide. Inner segments between 16 and 31 mm but usually 21 mm long and between 6 and 16 mm frequently 9 mm wide. Inside all segments are uniformly white without markings (Fig. 3e, f), outside of outer segments white or yellowish (buff-coloured), largely striped or speckled intensely all over the segment, deep brown-violet (Fig. 3e, g, h). Prophyll absent. Bract and bracteole present, skinny, silvery-white, speckled dark brown at the apex with age. Bracteole narrower than the bract but generally of the same length. Filaments 5-12 mm, on average 7.2 mm long, yellow, brownish at basis or vice versa or all brownish (Fig. 3f); anthers black, broadly arrow-shaped with long side-peaks rounded on top and occasionally with a notch in the middle, very thinly connected to the filaments, 6-13 mm on average 9 mm long, connective black. Pollen yellow. The styles are of a clear orange, divided into 3 branches which are slightly extended at the apex; branches 5-9 mm but usually 6.7 mm long, glabrous. The styles are always shorter to equal (100%) compared to the stamens (n = 29). Capsule and seeds not seen. Chromosome number 2n = 10.

Distribution and habitat: *Crocus multicosatus* (= multi-rippled) is named after its unusually high number of ribs in the grooves underneath the leaves. It is a very distinct crocus immediately recognisable even by the high number of these ribs alone, shared only with very few species e.g. *C. lydius*,

having (3) 4.5 (6) ribs (Kerndorff et al., 2011) or *C. colereus* (see no. 13 of this paper) having (2) 3 (4) ribs, and the dark brown speckled apex of the cataphylls, the relatively broad dark green leaves which are broadest in the middle and frequently reach or overtop the flowers at anthesis, the comparatively long filaments, the always shorter to equal length of the stamen, and the very peculiar corm tunic. Until now the plant is known to us only from the Lydian Bozdağlar in the Izmir Province. It grows in clearings of woods and temporarily damp places together with *Cistus creticus*, *Digitalis ferruginea*, *Cyclamen hederifolium*, *Ranunculus ficaria* subsp. *ficariiformis*, *Asparagus*, *Savia*, thistles etc.

Crocus multicosatus (HKEP 0401) was found to be identical to *C. incognitus* (HKEP 0201) in molecular analysis of the nuclear ribosomal internal transcribed spacer region (nrITS: ITS1 + 5.8S rDNA + ITS2). But both can be morphologically distinguished by corm tunic parameters, colour of cataphylls, colour of bract/bracteole; number and form of leaves and its ribs underneath; length of filaments and anthers as well as style-length relative to stamen. *C. incognitus* with 2n = 20 chromosomes might have been originated by polyploidization of *C. multicosatus* (2n = 10). In molecular analyses, *C. colereus* also belongs to this group as well as *C. nubigena* and *C. lydius*.

13. *Crocus incognitus* KERNDORFF & PASCHE, species nova

H o l o t y p u s: Turkey, Caria, Izmir Province, Boz Dağlar, 800-900 m, 12.3.2001, HKEP 0201 (Gatersleben, GAT 7465).

Cormus ca. 15 mm diameter, tunicae exteriores coriaceae, interiores molles; collum 2-6mm longum. Annuli adsunt, coriacei, cum dentibus bene evolutis >1 usque ad 3 mm. Cataphyllae argenteae albae. Folia aliquanta subulata 1-2.3-3, virida suffusa grisea, 2.5-3 mm diameter, apices acuti, glabra, folia nervis utroque costae latere (2)3. Folia superantia flores ad anthesim. Faux lutea vel saturate lutea usque ad brunneolam, glabra. Perinathii tubus albus, manifeste striatus violaceus vel omnino saturate violaceus ad apicem. Segmenta externa 18-30 mm, plerumque 24 mm longa (n = 28), 4-9 mm, plerumque 7 mm lata (n = 28). Segmenta interiora 16-27 mm, plerumque 21 mm longa, 5-11, plerumque 8 mm lata (n = 28). Segmenta interiora et exteriora intus alba. Latera exteriora extus alba, dense pinnatinervia violacea. Latera exteriora segmentorum interiorum alba cum macula brunneola versus perinathii tubum. Prophyllum abest. Bractea et bracteola adsunt, argentea, recutita, inconspicua. Filamenta 4-5.2-8 mm longa (n = 17), lutea, sine colore ad apicem, brunneola versus faucem, glabra. Antherae clare sagittatae, cum acuminibus infrequentibus longis bene separatis in extrema apicis parte subcaeruleis vel subnigris, 3-6.8-10 mm longae (n = 17). Connectivum atrocaeruleum vel nigrum; pollen flavum. Stylus aurantiacus usque ad rubrum-aurantiacum, divisus in ramos tres, rami stigmatici plus minusve 6.5 mm longi, dense scabridi usque ad papillosos. Stigma antheris brevior usque ad aequalem 63%, longior 37% (n = 27). Capsula et semina non visa. Chromosomatorum somaticorum numerus 20.

Corm around 15 mm in diameter, outer tunics coriaceous, the inner ones softer, neck 2-6 mm long, mostly consistent of rather broad-based triangles not significantly prolonged;

splits of tunics many, between 2 and 5 mm broad, sub-splits and notches present, many, mostly smaller than 0.5 mm; rings present, coriaceous with many well developed teeth of <1 to 3 mm. Cataphylls silvery-white. Leaves rather subulate 1-2.3-3, green with greyish tint, 2.5-3 mm in diameter, tips acute, glabrous, white stripe $\frac{1}{3}$ to $>\frac{1}{3}$ of leaf-diameter, (2)3 ribs underneath. Leaves overtopping the flowers at anthesis. Throat yellow or to deep yellow to brownish, no hair. Perianth tube white, prominently striped deep violet or entirely deep violet near apex. Outer segments between 18 and 30 mm but usually 24 mm long (n = 28), between 4 and 9 mm but usually 7 mm wide (n = 28). Inner segments between 16 and 27 mm but usually 21 mm long, between 5 and 11 mm but usually 8 mm wide (n = 28). Inside all segments are white. Outside of outer segments is white, heavily violet feathered (Fig. 3i, j). Outside of inner segments white with a bluish towards the perianth tube brownish spot. Prophyll absent. Bract and bracteole present, silvery, skinny, inconspicuous. Length of filaments 4-5.2-8 mm (n = 17), yellow, at the apex colourless, towards the throat brownish, no hair. Anthers significantly arrow-shaped with unusually long well separate lower peaks, bluish or blackish, 3-6.8-10 mm long (n = 17). Connectives dark blue or black; pollen yellow. Styles orange to orange-red, divided into 3 branches, branches in average 6.5 mm long, densely scabrid to papillose. Style length according to stamen is in 63% shorter to equal, in 37% longer (n = 27). Capsule and seeds not seen. Chromosome number $2n = 20$.

Distribution and habitat. *C. incognitus* (= disguised, because it is difficult to distinguish it from similar species) is until now only known from the type locality in the Boz Mountains in Izmir Province. It can easily be mixed up with *C. creweii*, *C. caricus*, and *C. colareus*. The plant grows on non-calcareous rocks together with *Pinus brutia*, *Quercus*, *Colchicum variegatum*, *Crocus chrysanthus*, *Chionodoxa*, *Inula*, *Acantholimon*, *Verbascum*, *Draba* etc.

14. *Crocus colareus* KERNDORFF & PASCHE, species nova

Holotypus: Turkey, Caria, Izmir Province, Aydin Dağları, 900-1000 m, 14.3.2003, HKEP 0314 (Gatersleben, GAT 23075).

Cormus magnus, 20-25 mm diameter; tunicae exteriores coriaceae, interiores molles; collum conspicuum, setosum, 5-7 mm longum. Annuli adsunt, coriacei, maiores aliquantum parvi, margine plena, superiores maiores et latiores dentibus. Dentes aut multi breviores quam 1 mm longi vel interdum 1-3 mm longi. Cataphyllae argenteae usque ad brunneolas. Folia 2-2.9-4, virida, 1-2 mm diameter, glabra, folia nervis utroque costae latere (2) 3 (4). Folia bene evoluta ad floratiorem, plerumque superans flores. Color faucis divisus in zonas tres. Suprema dilute flava, centrum brunneolum-luteum, brunneolum-violaceum ad basim, faux glabra. Perianthii tubus albus, striatus violaceus, saturate brunneolus-violaceus prope segmenta. Segmenta exteriora 14-25 mm, plerumque 21 mm longa (n = 38), 5-10 mm, plerumque 8 mm lata (n = 38). Segmenta interiora 14-24 mm, plerumque 20 mm longa, 6-12 mm, plerumque 9 mm lata (n = 38). Intus omnia segmenta clara alba, interdum nonnullae venae fusiores extrinsecus perlucens. Latera exteriora segmentorum exteriorum alba usque ad bubalina, aut dilute punctata aut grave

pinnatinervia violacea. Latera exteriora segmentorum interiorum alba, cum macula saturate brunneola apud perianthii tubum. Prophyllum abest. Bractea et bracteola adsunt, argentea, recutita, interdum brunneola ad apicem. Filamenta 7-8.6-10 mm (n = 38), saturate lutea apud antheras, brunneola ad basim segmentorum, glabra. Antherae late sagittatae, complanatae ad apicem, clare extrorsus, saturate nigrae, 5-7.7-10 mm longae (n = 38). Connectivum saturate nigrum, pollen luteum. Stylus aurantiacus usque ad aurantiacum-luteum, divisus in ramos tres, scabridus usque ad dense papillosum, rami stigmatici 3-5.5-8 mm longi (n = 38). Stigma antheris brevior usque ad aequalem 89%, longior 11% (n = 30). Capsula et semina non visa. Chromosomatorum somaticorum numerus 12.

Corm large, 20-25 mm in diameter; outer and inner tunics coriaceous, the inner ones softer; neck conspicuous, bristly, 5-7 mm long, consistent of broadly based triangles which are abruptly prolonged into acute tips; tunics split into mostly 2-5 mm broad segments, sub-splits and/or notches many, around 0.5 mm or less; rings present, coriaceous, the lower (older) ones rather small, whole-edged, the upper ones larger and broader with teeth. Teeth either many, smaller than 1 mm long or less frequent than 1-3 mm long. Cataphylls silvery to brownish. Leaves 2-2.9-4, green, 1-2 mm in diameter, glabrous, white stripe $\frac{1}{3}$ of leaf-diameter, (2) 3 (4) ribs underneath. Leaves at anthesis well developed, regularly overtopping the flowers. The throat-colour can be divided into three zones. The upper one being light yellow, the centre one brownish-yellow, and the deeper one dark brownish-violet, no hair. Perianth tube white, striped violet, near the segments deep brownish-violet. Outer segments between 14 and 25 mm but usually 21 mm long (n = 38), between 5 and 10 mm but usually 8 mm wide (n = 38). Inner segments between 14 and 24 mm but usually 20 mm long, between 6 and 12 mm but usually 9 mm wide (n = 38). Inside all segments are of a clear brilliant white, occasionally some darker lines from the outside are shining through. Outsides of outer segments are white to buff-coloured, either thinly speckled or heavily feathered violet or of transitional forms of these (Fig. 3k, m, n). The outsides of the inner segments are brilliant white, having a dark brown spot near the perianth tube which is surrounded by a yellow zone shining through from the yellow part of the throat. Prophyll absent. Bract and bracteole present, silvery, skinny, sometimes brownish at the tips. Length of filaments 7-8.6-10 mm (n = 38), deep yellow near the anthers brownish when attached to the segments, no hair. Anthers broadly arrow-shaped, flattened at tips, significantly extrorse, deep black, 5-7.7-10 mm long (n = 38). Connective deep black, pollen yellow. Style orange to orange-yellow, divided into 3 branches, scabrid to densely papillose, branches 3-5.5-8 mm long (n = 38). Style length according to stamen is 89% shorter to equal, 11% longer (n = 30). Capsule and seeds not seen. Chromosome number $2n = 12$.

Distribution and habitat. *C. colareus* (= colourful) is until now only known from the type locality in the Aydin Mountains of Izmir Province. The plant grows mainly on non-calcareous rocks together with *Castanea sativa*, *Quercus*, *Verbascum*, *Ranunculus*, *Trifolium*, ferns and grasses.

A determination key for the described species will be presented when all new taxa are described and published.

Acknowledgements

We are indebted to Ingo Schneider (Wustermark) for chromosome counts, and DFG for financial support of molecular work. We are especially thankful to Mr. Bernd Rier for his great support writing the Latin diagnoses. Last but not least we thank our families for the great interest, help and patience at any time.

References

- HARPKE, D., MENG, S., RUTTEN, T., KERNDORFF, H. & BLATTNER, F.R. (2013): Phylogeny of *Crocus* (Iridaceae) based on one chloroplast and two nuclear loci: Ancient hybridization and chromosome number evolution. — *Mol. Phylogenet. Evol.* **66**: 617-627.
- KERNDORFF, H. (1993): Two new taxa in Turkish *Crocus* (Iridaceae). — *Herbertia* **49**: 76-86.
- KERNDORFF, H. & PASCHE, E. (1994): *Crocus mathewii*. A new autumn-flowering *Crocus* from Turkey. — *The New Plantsman* **1**: 102-106.
- KERNDORFF, H. & PASCHE, E. (1997): Zwei bemerkenswerte Taxa des *Crocus biflorus*-Komplexes (Iridaceae) aus der Nordosttürkei. — *Linzer Biol. Beitr.* **29/1**: 591-600.
- KERNDORFF, H. & PASCHE, E. (2003): *Crocus biflorus* in Anatolia. — *The Plantsman, New Series, Volume 2, part 2*: 77-89.
- KERNDORFF, H. & PASCHE, E. (2004a): Two new taxa of the *Crocus biflorus* aggregate (Liliiflorae, Iridaceae) from Turkey. — *Linzer Biol. Beitr.*, **36/1**: 5-10.
- KERNDORFF, H. & PASCHE, E. (2004b): *Crocus biflorus* in Anatolia, Part Two. — *The Plantsman, New Series, Volume 3, part 4*: 201-215.
- KERNDORFF, H. & PASCHE, E. (2006): *Crocus biflorus* in Anatolia, Part Three. — *Linzer Biol. Beitr.*, **38/1**: 165-187.
- KERNDORFF, H. & PASCHE, E. (2011): Two new taxa of *Crocus* from Turkey. — *Stapfia* **95**: 2-5.
- KERNDORFF, H. & PASCHE, E. (2012): Seven new species of *Crocus* from Turkey. — *Stapfia* **97**: 3-16.
- PASCHE, E. (1993): A new *Crocus* (Iridaceae) from Turkey. — *Herbertia* **49**: 67-75.

Helmut KERNDORFF
Casa da Eira, São Romão, Cx 548 A
8150-058 São Brás de Alportel
Portugal

Erich PASCHE
Feldstraße 71
42555 Velbert
Germany

Dörte HARPKE & F. R. BLATTNER
Taxonomy & Evolutionary Biology
Leibniz Institute of
Plant Genetics and Crop Research (IPK)
D-06466 Gatersleben
Germany