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CROCUS VALLICOLA AND ITS ALLIES

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ABSTRACT. *Crocus vallicola* Herb. (Iridaceae) and six other closely related species constitute a distinct infra-generic group within the genus, occupying an area from the Caucasus southwards through eastern Turkey and Syria to the Lebanon. In Iran the group is represented by the comparatively recently discovered *C. gilanicus* Mathew. *C. suwarowianus* Koch is treated here as a subspecies of *C. kotschyanus* Koch and two further subspecies of the latter, *C. kotschyanus* subsp. *hakkariensis* Mathew and subsp. *cappadocicus* Mathew, are described. Natural hybrids are recorded between *C. vallicola* and *C. sharojanii*. The '*C. vallicola* group' is defined, descriptions of the taxa are provided and a key to the species is given.

There are approximately 90 known species of *Crocus*, distributed from Portugal and N Africa eastwards to the Ala Tau and Tien Shan mountains of Russia and western China. Many of the species in this primarily xerophytic genus occur in the Mediterranean and Irano-Turanian phytogeographical areas and are well adapted to survive the long dry summers of these regions. The damper regions within the area of distribution of *Crocus* are much less well-endowed with species, although the Colchic (Turkey and Russia) and Talysh (Iran) areas of the Euxino-Hyrcanian region do possess an interesting group of closely related taxa which generally occur in moist mountain meadows where summer drought is never extreme.

The distribution pattern of the species in this group is most interesting. Three species are confined to the mountains of the Colchic region and inhabit damp alpine meadows only. One species (*C. gilanicus*) occurs in a similar habitat in the Talysh-Elburz mountain region of the Iranian provinces of Gilan and Azerbaijan. Outside this area of northern Iran, southern Caucasus and north east Turkey there is the more widespread *C. kotschyanus* and its close relatives *C. karduchorum* [Kotschy ex] Maw and *C. ochroleucus* Boiss. & Gaill. *C. kotschyanus*, which is split into four subspecies, has the widest distribution of all the species in this group, ranging from western Transcaucasia and north east Turkey southeastwards diagonally across central Turkey to the Anti-Taurus mountains. Here the area of *C. kotschyanus* divides into two, one 'arm' extending into the Cilician Taurus and the other southwards into the Amanus mountains, western Syria and the Lebanon. It is interesting to note that this distribution agrees remarkably well with the theory of an 'Anatolian diagonal' floristic belt along which there occurs a number of endemic genera and species (Davis, 1971). *C. kotschyanus* does however have an outlying station in the mountains of Hakkâri (SE Turkey). The closely related and very restricted *C. karduchorum* Maw occurs in the mountains south of Lake Van, while *C. ochroleucus*, another allied but distinct species, has a more southerly distribution in southern Lebanon, southwest Syria and northern Israel.

G. Maw, in his magnificent monograph of *Crocus* (1886), followed Goldbach (1817), Gay (1831) and Herbert (1847) in dividing the genus initially on the presence or absence of a membranous prophyll subtending

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the pedicel. *C. vallicola* and its relatives possess such a prophyll and therefore fall into Division 1, *Involucrati*. As stated in a previous paper (Mathew, 1977), Maw's classification for groups subordinate to this breaks down in some instances, for he rigorously applied the characters of the corm tunic and flowering time and arrived at a very inflexible system which at times separates very closely allied taxa. On the whole, however, these features are very useful and if one is to classify the genus at all then they must be utilized, but in conjunction with several other factors. In *C. vallicola* and its allies the corm tunic is uniform and can therefore be used satisfactorily, and the species are all autumn-flowering. In Maw's system this group of species would be allocated to Division 1, *Involucrati*, Section 2, Fibro-Membranacei (tunic membranous with vertical veins), autumn-flowering group.

Before describing the individual species it is necessary to define the characteristics of the group, referred to here as '*C. vallicola* and its allies'. These are:

a) Prophyll present.
b) Bract present; bracteole absent or present.
c) Corm depressed-globose, sometimes lying on edge (i.e. axis horizontal).
d) Corm tunic thinly membranous with obscure veining.
e) Leaves hysteranthous (or synanthous in *C. ochroleucus* only).
f) Leaves T-shaped with the keel only slightly narrower than the lamina.
g) Anthers white (or yellow in *C. scharojanii* only).
h) Autumn-flowering.
i) Seed surface densely covered with flattened, deltoid, acute or obtuse papillae.
j) Mountain plants of C & E Turkey, S Caucasus, N Iran, Syria, Lebanon and N Israel.
k) 2n = 8, 10, 20, 24, 32 (the cytology of the group is considered in detail in the paper which follows—Brighton, 1980).

The species which possess these features are as follows: *C. vallicola* Herb., *C. scharojanii* Rupr., *C. autranii* Albov, *C. kotschyanus* C. Koch, *C. karduchorum* [Kotschy ex] Maw, *C. gilanicus* Mathew, *C. ochroleucus* Boiss. & Gaill.

Key to C. vallicola and its allies

1a. Flowers pale to deep yellow-orange; anthers yellow or orange; 2n = 8 . . . . . 2. *C. scharojanii*
1b. Flowers white, cream or pale lilac to violet; anthers pale cream or white; 2n = 8, 10, 20, 24, 32 2

2a. Perianth segments acuminate 3
2b. Perianth segments rounded to acute, rarely shortly and bluntly acuminate 4

3a. Bract not, or only slightly, exserted from the cataphylls (sheathing leaves); flowers violet with white throat; 2n = 32 . 3. *C. autranii*

3b. Bract over twice as long as the cataphylls; flowers white with yellow spots in throat; 2n = 8 . . . . . 1. *C. vallicola*

4a. Leaves appearing at, or immediately after, anthesis; flowers white with a deep yellow throat; 2n = 10 . 7. *C. ochroleucus*
4b. Leaves completely absent at anthesis and not appearing until at least two months later; if flowers white then throat at most marked with yellow spots 5

5a. Perianth segments white or only very faintly tinged with pinkish-lilac towards the tips, sometimes violet-veined 6
5b. Perianth segments lilac to violet 7

6a. Perianth glabrous at point of insertion of filaments; throat blotched with yellow; 2n = 20 . . . 4. *C. kotschyanus*
6b. Perianth pubescent at point of insertion of filaments; throat white or lilac with no yellow blotches; 2n = 24 . 6. *C. gilanicus*

7a. Perianth segments mid- to deep-violet, narrowly elliptic, acute; style and stigmatic branches orange; 2n = 32 . . 3. *C. autranii*
7b. Perianth segments pale bluish- or pinkish-lilac, obovate, oblanceolate or obtrullate, usually rounded or obtuse, rarely acute; style and stigmatic branches white to pale yellow . . 8

8a. Style creamy white, much-dissected into at least 20 branches; throat of perianth white with no yellow blotches; bracteole absent; 2n = 10 . . . . . 5. *C. karduchorum*
8b. Style usually yellow, ± 3-branched but sometimes more finely divided; throat of perianth white, usually with two yellow blotches at base of each segment; bracteole present; 2n = 8, 10, 20 . . . . . 4. *C. kotschyanus*

1. C. vallicola Herb. in Bot. Reg. 31, Misc. 2 (1845).
Types. [Turkey A7 Trabzon] 'in convalle monticulosa alpium Trapezunticarum ad pedes vallis orientalis summae in monte Koulak Dagh dicto', x 1843, *Kotschy*; x 1844, *Cartwright* (both n.v.—syntype specimens probably not in existence).

Corm vertical; *tunic* very thin with the fibres parallel near the base and anastomosing at the apex. Cataphylls 3–4, their tips just above soil level, completely sheathing the prophyll, young leaves, bract and flowers. *Leaves* 3–5, hysteranthous, at flowering time hidden within the cataphylls and not elongating until long after flowering, eventually 15–25(–30) cm long; keel nearly as wide as the lamina. *Flowers* solitary, white, sometimes veined purple; throat white with two yellow spots near the base of each segment, pubescent at the point of insertion of the filaments. Bract tubular with an oblique apex, about 3–8 cm long, well-exserted from the cataphylls, membranous, white often tinged green towards the apex; bracteole absent. *Perianth* tube about 4–14 cm long, white; segments oblanceolate or elliptic, long-acuminate, 3·5–5 × 0·7–1·2 cm, ± equal or the inner slightly smaller than the outer. *Filaments* white, 0·7–1·2 cm long, glabrous. Anthers linear, white, 0·9–1·6 cm long including the basal lobes; basal lobes 1–1·5 mm long; pollen creamy-white. *Style* white, creamy-yellowish towards the apex, divided for a length of 5–8 mm into 3 branches, each branch usually

shortly lobed and frilled; tips of style branches equal to or clearly exceeding the tips of the anthers. *Capsule* ellipsoid, 1·5 × 0·7 cm, raised on a short pedicel just above ground level when mature; seeds broadly ellipsoid, c. 2 mm long. 2n = 8.
Flowering period. August–September(–October).
Habitat. Pastures and fields, 1000–3000 m.
Distribution. USSR: W & S Transcaucasia; Ciscaucasia; NE Turkey.

2. C. scharojanii Ruprecht in Regel, Gartenflora 17:134, t. 578 fig. 2 (1868).
Syn.: *C. lazicus* (Boiss. & Bal.) Boiss., Fl. Orientalis 5:97 (1882).
Type. USSR, 'Nordabhange des westlichen Caucasus, im Lande de Abadsechen, im Quellengebiete der Bjelaja, in der Nähe des höhen Berges Oschten . . . , 1100 toisen', *Scharojan* (painting of type K).

Corm 0·5–1 cm diam., similar to that of *C. vallicola* but sometimes bearing stolons with cormlets at their tips. Cataphylls similar to those of *C. vallicola*. *Leaves* 3(–4), hysteranthous, those of the current season sometimes persisting until anthesis, external to the cataphylls; ultimate length 8–15 cm, breadth 1·5–3 mm with the keel nearly as wide as the lamina. *Flowers* solitary, deep yellow often shading to orange towards the tips of the segments; perianth tube yellow; throat yellow, glabrous. Prophyll present, subtending the base of the pedicel. Bract about 2·5–5 cm long, well-exserted from the cataphylls, membranous, white; bracteole absent. *Perianth* tube about 2–10 cm long; segments oblanceolate, obtuse to subacute or rarely acute, 2·5–4 cm, subequal. *Filaments* yellow, 0·7–1·1 cm long, glabrous. Anthers linear, cream or yellowish, 0·8–1·1 cm long including the 1–1·5 mm long basal lobes; pollen creamy-white. *Style* yellow, orange towards the apex, divided for a length of 2–5 mm into three slender branches, each branch frilled at the apex but not usually markedly expanded, the tips equalling or clearly exceeding the tips of the anthers. *Capsule* 1–1·5 cm long, ellipsoid, raised on a much-elongated pedicel up to 11 cm long; seeds broadly ellipsoid, 2·5–3 mm long. 2n = 8.
Flowering period. (July–)August–September.
Habitat. Moist grassy places, 2300–3500 m.
Distribution. USSR: W & S Transcaucasia; Ciscaucasia; NE Turkey.

3. C. autranii Albov in Bull. Herb. Boiss. 1:242, plate 9, fig. 1 (1893).
Type. 'In pratis alpinis montium calcareorum Abchasiae (mons Czipshira, alt. 7000 ped.)', *N. Albov* (BM, G, K, LE, P).

Corm 1–1·5 cm diam., similar to that of *C. vallicola*. Cataphylls similar to those of *C. vallicola*. *Leaves* 3–4, hysteranthous, at anthesis hidden within the cataphylls, not elongating until long after flowering time. *Flowers* solitary, violet with darker parallel veining on the segments, the lower part of the segments white, the border between the colours well defined; perianth tube white; throat white, pubescent at the point of insertion of the filaments. Prophyll present, 1·3 cm long, subtending the base of the pedicel. Bract 2·5 cm long, either included within the cataphylls or exserted by up to 1 cm; bracteole ligulate, much shorter than and completely enclosed within the bract. *Perianth* tube c. 4 cm long; segments erect, narrowly elliptic, 3·5–4 × 1–1·2 cm, the inner very slightly smaller

than the outer, the apex acuminate or rarely acute. *Filaments* white, 0·7–1 cm long, glabrous. Anthers linear, white, 0·9–1·2 cm including the 1–1·5 mm lobes; pollen creamy-white. *Style* yellow at the base, orange at the apex, divided for 0·6–1·2 cm into three branches, each branch expanded and cristate or shortly lobed at the apex; stigmatic surface funnel-shaped; tips of style branches about 4–7 mm above the tips of the anthers. *Capsule* not seen; seeds subglobose, c. 2 mm diameter. 2n = 32.
Flowering period. September–October.
Habitat. Alpine meadows, 2300 m.
Distribution. Known only from USSR, Abchasia in Chisshir area.

4. C. kotschyanus C. Koch in Ind. Sem. Hort. Berol. 1853:17 (1853) non Boiss., Fl. Orient. 5:102 (1882) (= *C. cancellatus* Herb.).

Corm 1–3 cm diam., vertical or lying on its side, sometimes producing stolons (in Lebanon), the tunic similar to that of *C. vallicola*. Cataphylls 3–5. *Leaves* 4–6, hysteranthous, not visible at anthesis and emerging long after flowering time, eventually up to 30 cm long, 1·5–4 mm wide with the keel nearly as wide as the lamina. *Flowers* 1(–2), pale bluish-or pinkish-lilac with darker parallel veins and two yellow or orange blotches towards the base of each segment, rarely the blotches merging or absent; throat white or yellow, glabrous or pubescent. Prophyll present, subtending the base of the pedicel. Bract not or only slightly exserted from the cataphylls; bracteole present, included completely within the bract. *Perianth* tube 3–13 cm long; segments obovate, oblanceolate or obtrullate, 2·5–4·3 × 0·6–1·8 cm, rounded, obtuse, subacute or bluntly and abruptly acuminate. *Filaments* 3–8·5 mm long, white or pale yellow, glabrous. Anthers linear, (0·7–)0·9–2 cm long, creamy-white; pollen white. *Style* yellow throughout or yellow towards the apex, divided for 0·4–1·2 cm into 3 branches, each of these sometimes subdivided into several shorter branches, occasionally multifid, the tips of the branches about equal to the tips of the anthers or overtopping them by up to 1 cm. *Capsule* cylindrical or ellipsoid, 1·1–2·5 × 0·6–0·7 cm, raised on a pedicel 4·5–12 cm long when mature; seeds globose, c. 2 mm diam., to ellipsoid, c. 2·5–3 × 2 mm.

C. kotschyanus presents the most difficult taxonomic problems in the group and further detailed field studies over the entire range of the species are very desirable. Present knowledge enables me to recognise four subspecies, which can be distinguished as follows.

1a. Flowers white or rarely pale lilac, throat glabrous, corm lying on its side; 2n = 20 . . . . . 4d. subsp. *suwarowianus*
1b. Flowers lilac, throat glabrous or pubescent, corm lying on its side or upright; 2n = 8, 10 2
2a. Corm upright, but sometimes rather misshapen . . . . 4a. subsp. *kotschyanus*
2b. Corm lying on its side 3
3a. Throat glabrous; perianth segments obovate or oblanceolate . . 4c. subsp. *cappadocicus*
3b. Throat clearly pubescent; perianth segments obtrullate . . . 4b. subsp. *hakkariensis*

4a. subsp. **kotschyanus**

In cultivation there is a frequently grown and very distinct plant originating from a collection by Siehe which can be recognised at varietal level. The two varieties of subsp. *kotschyanus* are distinguished as follows.

Perianth segments with two yellow spots internally near the base; flower with a small white, lilac or pale yellow centre; style branches yellow . . . . . 4aa. var. *kotschyanus*

Perianth segments with no yellow spots internally; flower with a large white zone at the centre; style branches creamy-white . . . 4ab. var. *leucopharynx*

4aa. subsp. **kotschyanus** var. **kotschyanus**

Syn.: *C. zonatus* [Gay ex] Klatt in Linnaea 34:682 (1865–66).
C. ponticus Siehe (? ined.).

Type. Turkey ?C5 Içel, cult. Berlin from corms collected 'in montibus Tauri', *Kotschy* (?B). There are several Kotschy collections of this species and it is impossible to say which is the type.

Flowering period. September–October.

Habitat. Mountain meadows, open stony places and in sparse scrub, 550–2600 m.

Distribution. C & S Turkey, NW Syria, C & N Lebanon.

Within the area of distribution of var. *kotschyanus* there is chromosome variation (Brighton, 1980), the populations from the Taurus mountains having a diploid number of $2n = 8$ and those from the Amanus range $2n = 10$. I have at present been unable to link this difference to any morphological or ecological characters.

A collection with $2n = 20$, from Doğanşehir in Malatya vilayet, is inseparable from the rest of the material of subsp. *kotschyanus* var. *kotschyanus* and in fact Brighton (1980, p. 400) considers that it may be an autotetraploid based on the $2n = 10$ karyotype, which is typical of the Amanus plants.

In addition to those areas in Turkey mentioned above, *C. kotschyanus* extends into Lebanon. The collections from Syria and Lebanon appear to belong to subsp. *kotschyanus* but living material is not available for study at present. The Lebanese plants appear to have corms which produce stolons in a similar way to those of *C. scharojanii*.

C. ponticus is a name given by Siehe to specimens (BM, E) collected by him in 'sud Pontus, nordl. v. Halys'. It is probably an unpublished name, and the specimens appear to represent *C. kotschyanus* subsp. *kotschyanus* var. *kotschyanus*.

4ab. subsp. **kotschyanus** var. **leucopharynx** B. L. Burtt in Gard. Chron. Ser. 3, 124:118 (1948).

Type. Turkey ?C5 Içel, Cilicia, *Siehe* s.n., cult. spm. from Kew, fl. x 1947 (holo. K).

Flowering period. October.

Habitat. Unknown.

Distribution. S Turkey.

It is curious that this rather distinct variety has not been collected in southern Turkey since the time when Siehe first introduced it from an unspecified locality. In general it resembles the Cilician var. *kotschyanus* but the very clearly outlined large central zone of white gives it a strikingly different appearance. A mere absence of the yellow spots at the base of each perianth segment does not produce the same effect. Forms of var. *kotschyanus* in which the spots are lacking do rarely occur, but the remaining central zone is then quite small and ill-defined. In view of this and in the absence of any further data about wild populations of var. *leucopharynx* I have no hesitation in maintaining this plant at the varietal level.

4b. subsp. **hakkariensis** Mathew, **subsp. nov.**

A subsp. *kotschyano* perianthii segmentis obtrullatis et cormi axilla semper horizontaliter disposita differt.

Type. Turkey C10 Hakkâri: Yüksekova to Şemdinli, 15 km from Yüksekova, 1100 m, 27 ix 1974, *T. Baytop* (ISTE 31140) (holo. K; iso. E, ISTE).

Flowering period. September–October.

Habitat. Rocky or gravelly places in mountain steppe, 1100–3250 m.

Distribution. SE Turkey.

This subspecies occupies an area in Hakkâri vilayet well away from the general distribution of *C. kotschyanus*. With its corm 'on edge' it approaches subsp. *cappadocicus* and subsp. *suwarowianus* but the perianth throat is pubescent like that of subsp. *kotschyanus*. The markedly obtrullate perianth segments are rather distinctive since in the other subspecies they are obovate or oblanceolate. The chromosome complement is $2n = 10$ but the karyotype can be distinguished from that of the other subspecies with $2n = 10$ (Brighton, 1980).

4c. subsp. **cappadocicus** Mathew, **subsp. nov.**

Subsp. *kotschyano* similis sed fauce glabro et cormi axilla semper horizontaliter disposita differt.

Type. Turkey B6 Sivas: Malatya to Pinarbaşi, Ziyaret pass, 1980 m, 19 ix 1978, *Mathew, T. Baytop & Leep* (ISTE 41499) (holo. K; iso. E, ISTE).

Flowering period. September.

Habitat. Limestone slopes and alpine turf, 2000–2700 m.

Distribution. Turkey: C & E Anatolia (Cappadocia & upper Euphrates).

This is distributed on the Munzur Dağ range and to the south-east of this, in the south of Kayseri vilayet. It is very similar to subsp. *suwarowianus* in its glabrous perianth throat and corm orientated on its edge, but it always has lilac flowers and has a different chromosome complement (Brighton, 1980).

4d. subsp. **suwarowianus** (C. Koch) Mathew, **comb. & stat. nov.**

Syn.: *C. suwarowianus* C. Koch in Linnaea 21:633 (1848).
C. vallicola Herb. var. *suwarowianus* (C. Koch) Maw in Gard. Chron. 16:148 (1881).
C. vallicola var. *lilacinus* Maw, loc. cit.

C. zorhabii Maw, loc. cit., in syn.
C. karsianus Fomin in Fomin & Voronov, Key Pl. Caucasus & Crimea 1:292 (1907).

Type. USSR: Caucasus, Letschkum, 2–6000 ft, *Suwaroff* (?B, ?LE); Passin, 6000 ft, *C. Koch* (?B, ?LE).
Flowering time. (August–)September–October.
Habitat. Short dryish turf or bare rocky places in upland steppe, 2000–3100 m.
Distribution. USSR: W Transcaucasia, S Ossetia; NE Turkey.

This subspecies is immediately recognisable by (a) creamy white flowers with glabrous perianth throats and (b) the corms lying on their sides. Very rarely, however, there are extremely pale lilac forms occurring in otherwise white-flowered populations. It is this which has contributed to the decision to consider *C. suwarowianus* as a subspecies of *C. kotschyanus*. The chromosome complement is $2n = 20$, a number not encountered in any of the other subspecies.

C. kotschyanus subsp. *suwarowianus* is distributed from the Caucasus southwestwards to Giresun and Sivas vilayets in Turkey. Although it is superficially very similar to *C. vallicola*, the two are clearly separated by their habitat and in several morphological characters. The upright corm of *C. vallicola*, together with the acuminate tips to the perianth segments, pubescent throat, long-exserted bract and generally larger flower size set it well apart from the *C. kotschyanus* complex. In Turkey, *C. vallicola* is a plant of moist alpine turf (although not the very wet places which are the habitat of *C. scharojanii*) on the damper north side and summit of the Pontic mountain range. *C. kotschyanus* subsp. *suwarowianus*, on the other hand, is more typically a part of the Irano-Turanian element, also occurring on the upper Pontic slopes but tending to prefer the drier or south-facing aspects. Away from the Pontus, it occurs southwards as far as the Palandöken range south of Erzurum, but in a similar habitat. To the southwest of this it is replaced by subsp. *cappadocicus* in the Munzur Dağ south of Erzincan.

5. C. karduchorum [Kotschy ex] Maw in Gard. Chron. 16:234 (1881).
Type. Turkey, Bitlis, Şirvan to Bahçesaray (Müküs), *Kotschy* 449 (K).

Corm 1–1·3 cm diam., lying on its side, or partly so; tunic similar to that of *C. vallicola*. Cataphylls 3, similar to those of *C. vallicola*. *Leaves* hysteranthous, emerging long after flowering, occasionally those of the previous season persisting until flowering time. *Flowers* honey-scented, lilac-blue, veined darker, grading to white at the base of the segments so that the central zone of white is ill defined (cf. *C. kotschyanus* subsp. *kotschyanus* var. *leucopharynx*); perianth tube white; throat white, pubescent. Prophyll present. Bract present, tubular with an oblique apex, 1·5–4 cm long, the tip not, or only just, exceeding the cataphylls; bracteole absent. *Perianth* tube 4–9 cm long; segments oblanceolate, subequal, 3·5 × 0·8–0·9 cm, the apex acute. *Filaments* white, 0·5 cm long, glabrous; anthers linear, 0·9 cm long including the basal lobes, creamy-white; pollen creamy-white. *Style* creamy-white, divided for 0·7–1·4 cm into at least 20 slender thread-like branches which are widely divergent and the outermost somewhat reflexed, the tips of the branches exceeding the anthers by about

1–2 cm. *Capsule* ellipsoid, c. 1 × 0·4 cm; seeds broadly ellipsoid, c. 1·5 mm long. 2n = 10.
Flowering period. September–October.
Habitat. In *Quercus* scrub in mountains, 1950–2000 m.
Distribution. Turkey: Bitlis vilayet, between Hizan and Tatvan and between Bahçesaray (Müküs) and Şirvan.

The description is taken from the type collection and *T. Baytop* (ISTE 31134).

6. C. gilanicus Mathew in Mathew & Wendelbo, Flora Iranica, Iridaceae No. 112:11 (1975).
Type. Iran, W Azerbaijan, between Herowabad (Khalkal) and Asalem (Navrud), 2400 m, 21 x 1973, *A. Shirdelpur* 10486 (holo. K, iso. TARI).

Corm c. 0·5–1 cm diam., lying on its side or partly so; tunic similar to that of *C. vallicola*. Cataphylls 3–4, white, the inner ones rather fleshy and ventricose. *Leaves* 3–4, hysteranthous, emerging long after anthesis, at maturity up to 10 cm long and 2·5 mm wide with the keel nearly as wide as the lamina. *Flowers* white with purple veins, sometimes very faintly suffused with pale pinkish-lavender towards the tips of the segments; perianth tube white; throat white, pubescent. Prophyll present, about 1–2 cm in length, subtending the base of the pedicel. Bract present, 0·8 cm long; bracteole absent or present (?). *Perianth* tube 3–7 cm long; segments more or less equal, narrowly oblanceolate or elliptic-lanceolate, 2·2–3·5 × 0·4–0·8 cm, sharply acute or slightly acuminate. *Filaments* 0·5–1 cm long, glabrous, white. Anthers linear, 0·5–0·9 cm long, creamy-white. *Style* yellow, divided for a length of 3–4 mm into 3 orange branches, each branch expanded and finely lobed; tips of the branches about equal to slightly exceeding the tips of the anthers. *Capsule* ellipsoid, c. 1·2 × 0·7 cm, situated just above ground level at maturity; seeds subglobose, c. 2·5 mm diam. 2n = 24.
Flowering period. October.
Habitat. Beech forest and grazed meadows, 1500–2400 m.
Distribution. Iran: Provinces of Azerbaijan and Gilan.

In its superficial appearance *C. gilanicus* most resembles *C. kotschyanus* subsp. *suwarowianus*, which also has smallish white flowers. It, however, differs from the latter in the absence of yellow blotches in the pubescent throat, the shorter anthers, and the chromosome number. Whether a bracteole is absent or present is a point which has yet to be determined. The dissection of a flower of the type collection suggested that it was absent, whereas a later collection, *Wendelbo & Shirdelpur* 14870, definitely possessed a small ligulate bracteole inside the bract.

7. C. ochroleucus Boiss. & Gaill., Diagn. Ser. 2, 4:93 (1859).
Type. Lebanon, 'prope Scanderoun supra Sidonem', *Gaillardot* (G).

Corm 0·5–1·5 cm diam., upright, producing many offsets; tunic similar to that of *C. vallicola*. Cataphylls 3–4 with green-veined tips just reaching above soil level. *Leaves* 3–6(–7), synanthous, at anthesis often very short but rarely not visible and even then appearing immediately after flowering time, elongating to 6–15 cm at maturity in spring, 1–1·5 mm wide with the keel slightly narrower than the lamina. *Flowers* 1–3(–5), creamy-white;

perianth tube white; throat and lower part of perianth segments deep yellow, pubescent at the point of insertion of the filaments. Prophyll present. Bract 2–6 cm long, not exserted from the cataphylls, or with the tip just visible; bracteole present, smaller and narrower and included within the bract. *Perianth* tube 5–8 cm long; segments equal or the inner distinctly smaller than the outer, elliptic or oblanceolate, obtuse to subacute, (1·7–)2·3–3·7(–4·2) × 0·7–1 cm. *Filaments* yellow, 4–5 mm long, glabrous. Anthers linear, white or cream, 5–10(–16) mm long, including the 1 mm long basal lobes; pollen creamy-white. *Style* pale yellow, deeper yellow towards the apex, divided for a length of 2–9 mm into 3 branches, each branch usually shortly lobed or frilled, the tips of the style branches usually exceeding, but sometimes equalling, the tips of the anthers. *Capsule* oblong-ellipsoid, 0·7–1 × 0·3–0·5 cm, raised on a pedicel 1–3 cm above ground level when mature; seeds subglobose, c. 1·5 mm diam. 2n = 10.
Flowering period. October–December.
Habitat. Rocky or stony areas on limestone, 300–1500 m.
Distribution. SW Syria; Lebanon; N Israel.

C. ochroleucus has been reported variously as having no hairs in the throat, no prophyll or no bracteole. In the experience of the author these observations are not correct.

Hybrids

The only natural hybrids known to occur in this group of *Crocus* are between *C. vallicola* and *C. scharojanii*. One specimen of a plant with this parentage has been observed in the living state by the author and it was intermediate in its chracters. It was collected by Dr J. R. Marr on the Soğanli Pass in eastern Turkey (*J.R.M.* 143). The cytological studies of this individual by Brighton (1980) confirm that it originates from these two species.

Yabrova (1947) has recorded a variable series of such specimens in the Caucasus where the two species grow together. Those plants which most resemble the former species have been described as *C. vallicola* var. *intermedia* Yabrova, and those closest to the latter as *C. scharojanii* var. *flavus* Lipsky (1898). Yabrova's hypothesis that *C. suwarowianus* C. Koch is yet another 'stage' in this transitional series of hybrids is quite unacceptable in my opinion. It is much more closely related to *C. kotschyanus* and in this paper is treated as a subspecies of that species.

Discussion

It is clear that the seven species reviewed above consitute a distinct, well-defined group within the genus with no near relatives. Of the seven, six are relatively restricted in their distribution and habitat and are fairly uniform in their specific characters, whereas *C. kotschyanus* is a widespread and variable plant which is treated here as consisting of four subspecies.

The curious feature of the corm lying on its side which occurs in some of the subspecies of *C. kotschyanus* is difficult to explain. It is a strongly developed character, for if such a corm is planted in the 'normal' upright way it will in the space of a year or two re-orientate itself into an 'on-edge'

position. Conversely, if a corm from one of the subspecies which normally produce upright corms is planted on its side it will pull itself back to the vertical. It has been suggested that this condition is associated with damp habitats, but this is not well supported by the facts concerning *C. kotschyanus* subsp. *suwarowianus* and *C. vallicola*. The former, a plant of dryish habitats (although much less of a xerophyte than many *Crocus* species), has an extremely asymmetrical corm, whereas *C. vallicola* which occurs in much damper situations has an upright symmetrical corm, as indeed do several other species from moist habitats. There is a tendency for certain *Crocus* species from damp habitats to be stoloniferous, for example *C. scharojanii* Rupr., *C. gargaricus* Herb. and *C. nudiflorus* Smith. A stolon, produced from an axillary bud on the corm's circumference, is in effect an extension of the corm itself. The stolon bears scales with axillary buds in the same way that the parent corm does, with its scale-like tunics and associated buds. It is possible that the 'on-edge' corm represents a variation of the stoloniferous habit—not a well developed one, since progress laterally through the soil would be very slow indeed, but nevertheless the growing point is situated in a lateral position and sideways growth must be possible. However, even if this hypothesis has some foundation, the purpose of the process remains obscure! The stoloniferous habit in cormous Iridaceae is not, incidentally, limited to *Crocus*. It is also present in some South African plants such as *Gladiolus sempervirens* Lewis and *G. papilio* Hook. f., which also occur in wet habitats. It may be postulated that the habit has reached an extreme in waterside plants of the genus *Schizostylis* from South Africa where the corm is more or less absent and the underground part of the plant consists mostly of stolons.

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