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Morphological and Anatomical Investigations on Some Species of *Colchicum* L. Occurring in South East Anatolia, Turkey

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Abstract: In this investigation, some morphological and anatomical characteristics of *Colchicum crocifolium* Boiss., *C. serpentinum* Woron. ex Miscz., *C. cilicicum* (Boiss.) Dammer, *C. szovitsii* Fisch. and Mey. and *C. persicum* Baker were observed. Detailed descriptions of these five taxa of *Colchicum* which occur in Şanlıurfa, Adıyaman and Mardin, South East Anatolia, are provided in this study and their morphological and characteristics are compared with those given in the Flora of Turkey. The specimens were collected from the different part of Şanlıurfa and Adıyaman within C7 and Mardin within C8 of the grid system. Their habit and anatomical structure are illustrated. The determination of anatomical studies of presented *Colchicum* sp. in this work, is the first data available in the literature.

Key words: Anatomy, *Colchicum*, Liliaceae, morphology, Turkey

INTRODUCTION

The genus *Colchicum* L. in its most inclusive sense (incl. *Merendera* RAM. and *Bulbocodium* L.) includes c. 90 species^[1-5], which are very unevenly distributed. The Balkan Peninsula is one region very rich in species (35), though the majority of those are concentrated to Greece (31 incl. The Aegean Islands). Only Turkey has more species (42)^[6-8].

The high frequency of species and endemics (c. 35%) within *Colchicum* L. (incl. *Merendera* Ram.) in Turkey indicates this region as a major centre of diversity and speciation^[9-11]. About 60% of the species are autumn-flowering with hysteranthous leaves. The confusion and taxonomic difficulties within this group are reflected both in literature and herbaria and also in the fact that very few new species have been described before the end of the twentieth century despite rather extensive collecting. A fairly large portion of the genus *Colchicum* in Turkey has recently been revised by Persson^[1,2,6]. Then, a new record was found for the Flora of Turkey by Akan and Eker. The specimens were identified as *Colchicum crocifolium* Boiss., after which the total number of *Colchicum* taxa increases to 36^[12].

The anatomical structure of the stem and leaves of five *Colchicum* species in South East Anatolia are described in this paper. Some studies have been carried out previously by Akan and Eker^[13], Kandemir and Engin^[14], Kandemir *et al.*^[15], Çoşkunçelebi and Beyazoğlu^[16], Koca^[17], Uysal^[18,19], Küçüker^[20,21], Özhatay

and Üstün^[22] on different genera belonging to Iridaceae and Liliaceae.

MATERIALS AND METHODS

Specimens were gathered from different part of Şanlıurfa and Adıyaman which are located in the C7 square and Mardin (Nusaybin) in the C8 of the grid system. A collector number was given and the specimens were dried according to standard herbarium methods. These are kept in the herbarium of Harran University and GAZI. The Flora of Turkey and the East Aegean Islands^[7], Flora Iranica^[23], Flora of Syria^[24] and Flora of Iraq^[25] were used to identify the plant samples.

For anatomical analysis specimens collected from the field were preserved in labelled bottles in 70% alcohol. Transverse sections and surface preparations of root and leaves were made manually for anatomical studies. Sartur^[26] reactives were applied to the sections for a better understanding of some anatomical structures. Olympus BX50 binocular microscope with drawing tube were used in anatomical studies. Photographs were taken by Olympus Camedia.

RESULTS

Morphological characteristics:

Colchicum crocifolium Boiss., Diagn. Pl. Or. Nov. Ser. 1, 5:67 (1844) (Fig. 1).



Fig. 1: *Colchicum crocifolium* Boiss.; A-Habit, B-Perianth and C-Stamens

Corm oblong-ovoid, 2-3.5 x (0.7-) 1-2.5 cm, tunics membranous to subcoriaceous or coriaceous; dark reddish-brown to dark-brown, produced into a neck (2-) 3-8.5 cm. Cataphyll usually long and thin, (4-) 5-18 cm. Leaves synanthous, 3-30, linear to filiform, at anthesis 3-8 visible, extending 1-9 cm from cataphyll, barely equalling or, in multi-flowered specimens, exceeding the flowers towards end of flowering-period, 0.4-5 mm wide, erecto-patent to recurved-circinnate slightly channelled or occasionally convulate; at maturity 7-18 cm x 1.5-11 mm, erecto-patent to prostrate-circinate and \pm twisted, filiform to linear, shallowly channelled or flattish, subacute to subobtusate-cucullate, dull somewhat greyish green, glabrous or \pm densely ciliate on margins, or \pm hirsute on both sides or only on back-sides or leaf sheaths. Flowers 1-30, perianth tube entire, not or shortly exceeding the cataphyll by up to 2 cm, filiform, yellowish-white to white or rarely palest lilac-pink. Limb narrowly infundibuliform, segments 1-2.5 cm x 1-5 (-7.5) mm, filiform to linear, long-tapering to an acute to subobtusate tip, often \pm curved-twisted in uppermost part. Filaments 4-8 (-9) mm, white often pale yellowish in lower half or palest lilac-pink. Swollen base orange-brown to reddish-brown. Anthers versatile, 2-4 mm, purplish-green or yellowish-brown or purplish-gray; pollen yellow. Styles

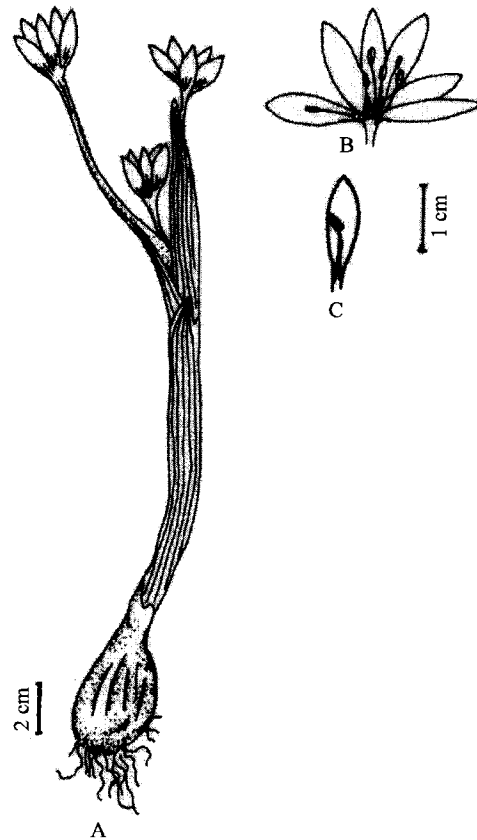


Fig. 2: *Colchicum szovitsii* Fisch. and Mey.; A-Habit, B-Perianth and C-Stamens

overtopping stamens, straight or slightly curved at apex, whitish, stigmas punctiform. Capsules at ground level, 9-20x5-10 mm, ovoid to elipsoid-globose, rounded at apex or shortly pointed, often papillose to shortly hirsute on entire surface; seeds c. 1-14 per locule, 2-3 mm in diam., dark reddish-brown to blackish-brown, raphe region swollen to a long, yellowish-white ridge. $2n = 14$.

Habitat: Dry steppic hill slopes on stony or rocky ground, open places, dry fallows fields, 500-1100 m.

Specimens examined: (Turkey): C7 Şanlıurfa-Viraşchir 25. km, fields, 02.03.2003, 500-550 m, Akan 4232, C8 Mardin: Nusaybin, Girmeli village, 09.02. 2003, 1000 m, open fields, Akan 4774.

Colchicum szovitsii Fisch. and Mey. in Ind. Sem. Horti Petrop. 1:24 (1835) (Fig. 2).

Corm ovoid, 1.5-4x1-3 cm, outer tunic blackish-brown, inner reddish-brown, papery to subcoriaceous, neck absent or vestigial. Leaves synanthous, 2-3, ligulate or very narrowly linear-lanceolate, suberect, extending 2-6

(-12) cm at anthesis, (12-) 16-21 (-25) x (1-) 2-3.5 cm at maturity, apex acute and often cucullate, glabrous. Flowers (1-) 2-6 (-9), ovoid-campanulate, sometimes campanulate or narrowly campanulate. Perianth segments deep to pale purplish-pink, oblanceolate to very narrowly elliptic, (2-) 2.4-3 (-3.5) cm x 3-10 mm, acute or less frequently obtuse, occasionally with basal auricles. Filaments 7-11 mm, glabrous; anthers purplish-black or greenish-black, 2-4 (-5) x 1 mm; pollen yellow. Styles straight, stigmas punctiform. Capsules elipsoid to rotund, 3.5 (-4) x 1.5-2.2 cm, mid-brown, glabrous, apiculate.

Habitat: Rocky places, stream side.

Specimens examined: (Turkey): C7 Şanlıurfa: Siverek, Karacadağ, Rame Stream, 28.03.2003, 1415 m, Akan 5398.

Colchicum cilicicum (Boiss.) Dammer, Gard. Chron. Ser. 3, 23:34(1898) (Fig. 3).

Corm subglobose to ovoid, (3-) 3.5-5.5 (-6) x 2.5-4 (-5) cm, outer tunics dark brown, inner reddish-brown, papery to subcoriaceous, apex produced into a persistent neck 4-16 cm. Leaves 3-4 (rarely 5), hysteranthous, suberect, very narrowly elliptic to narrowly elliptic-lanceolate, 17-30 (-40)x(2.5-) 4-7 (-10) cm, apex rounded to obtuse, glabrous. Flowers 2-5 (-7), funnel-shaped to campanulate; perianth

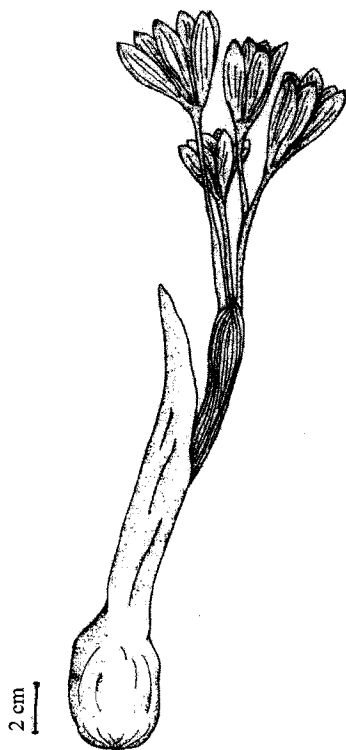


Fig. 3: The habitus of *Colchicum cilicicum* (Boiss) Dammer

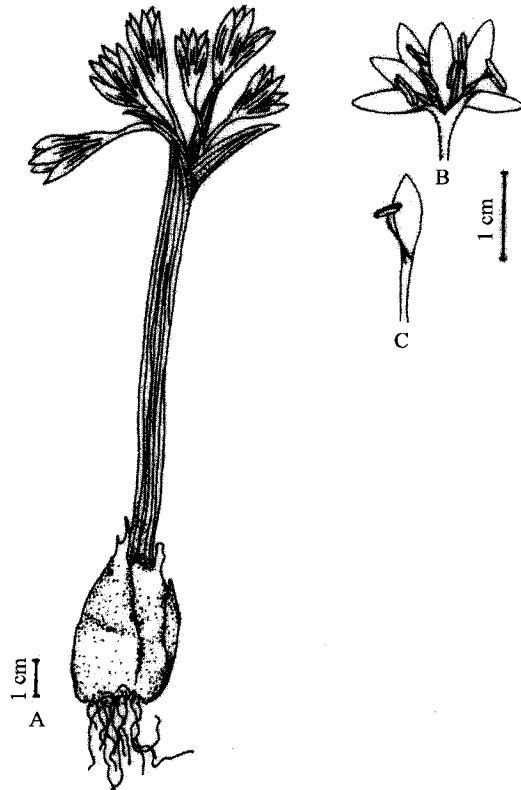


Fig. 4: *Colchicum serpentinum* Woron. ex Miscz, A-Habit, B-Perianth and C-Stamen

tube entire, exceeding the cataphyll by 4-15 cm, 2-6 mm wide, white to cream. Perianth segments pale lilac-purple to deep rosy-purple, distinctly or lightly tessellated, oblanceolate to elliptic, (2,5-) 3-7.5 x (0.5-) 0.7-2.5 cm, rounded to subacute, pubescent along ridges of filament channels. Filaments 2.5-3.5 cm; anthers bright yellow, 6-10 (-15) x 1 mm; pollen bright yellow. Styles very long, straight, usually overtopping stamens, stigmas punctiform or very shortly decurrent. Capsules narrowly ovoid to subglobose, elevated on stem prolonged above ground, 2.5-5.5x1.5-3 cm, glabrous or hispid, apiculate; seeds numerous, ±globose, c. 3-4 mm diam., brown. 2n = 54.

Habitat: Rocky mountain slopes, field side, in steppe or macchie.

Specimens examined: (Turkey): C7 Şanlıurfa: Şanlıurfa-Diyarbakır 18. km, Kabahaydar village, steppe, 26.09.2002, 755 m, Akan 4180.

Colchicum serpentinum Woron. ex Miscz. in Fl. Cauc. Crit. 2:114 (1912) (Fig. 4).

Corm 2-4x1-2 cm, ovoid; outer tunics dark reddish-brown, inner reddish-brown, papery to subcoriaceous usually persistent; neck absent or vestigial. Leaves 3 (-4),

synanthous, narrowly linear, canaliculate, (1-) 2-6 (-8) cm at anthesis, 9-15 (-20) cm x 1-4 (-7) mm at maturity, acute to obtuse, glabrous, scabrous or with margins and dorsal surface sparsely to densely hispid. Flowers (1-) 2-5 (-10), stellate or narrowly funnel-shaped. Perianth segments white to purplish-pink, very narrowly to narrowly elliptic or narrowly oblanceolate, 1.1-2.5 cm x 2-5 (-6) mm, acute, occasionally subacute or obtuse, Filaments 6-10 mm, glabrous; anthers greenish-black or blackish-brown, 3-5 (-5.5) x 1-1.5 mm; pollen yellow. Styles straight, stigmas punctiform. Capsule narrowly ovoid to subglobose, 1-1.5 (-2) cm x 8-12 mm, glabrous or hispid, apiculate.

Habitat: Stony places.

Specimens examined: C7 Adyaman: Kuyulu, small hills, 28.01.2003, 655 m, Akan 5399.

5- *Colchicum persicum* Baker in Linn. Soc. Bot., 17:430 (1879) (Fig. 5).

Corm 3.5-7.5x2-4 cm. ellipsoid-ovoid to ovoid, often somewhat flattened; tunics orange-brown to deep red-brown, membranous to submembranous, outer ones subcoriaceous to coriaceous, duller and darker brown; apex produced into a truncate neck 7-16 (-20) cm. Leaves 5-10 (-13), hysteranthous, spreading-erect to spreading-falcate, linear or linear-lanceolate to lanceolate (more rarely oblong), 7-15x0.4-2 (-3.5) cm, very variable in width both within individuals and between populations, subacute to obtuse or truncate to retuse, shallowly channelled to ±flattish, often slightly twisted, somewhat pale green, glossy, often rather stiff, leathery; margins somewhat undulate to densely fine-undulate, often distinctly cartilaginous, glabrous or ±scabrous. Flowers 2-6 (-9), widely funnel-shaped. Perianth tubes stout, not or only shortly exceeding neck, segments pinkish-purple or lilac-purple to saturated violet-purple with a pale median stripe, rarely very faintly tessellated, linear or elliptic-oblanceolate to oblanceolate or obovate, (2.4-) 2.8-5 cm x 5-13 (-19) mm, upper sides usually with a distinct groove, subacute to subobtuse, not or ± apiculate to acuminate; filament channels glabrous. Stamens (1.2-) 1.5-3.3 cm, mostly inserted to c. 9 mm down into tube; filaments white to yellowish-white, often wholly or in upper part tinged with purplish, slightly swollen base yellowish; anthers yellow, very rarely greyish-or brownish-violet, (4-) 5-10 (-13) mm; pollen yellow. Styles slender, apex not or somewhat swollen, straight or slightly hooked, stigmas hardly or shortly decurrent, 0.5-1.5 (-2) mm. Capsules narrowly oblong to ellipsoid-oblong, (1.5-) 3-5x0.8-1.8 cm, usually distinctly Brown-dotted when dry, short-pointed to narrowly rostrate. $2n = 54$.

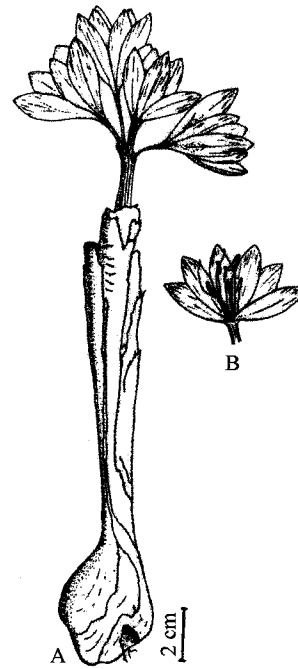


Fig. 5: *Colchicum persicum* Baker; A-Habit, B-Perianth

Habitat: Rocky places, stream side.

Specimens examined: (Turkey): C7 Şanlıurfa: Halfeti, Halfeti-Karaotlak village, 9.10.2004, 640 m, Akan 5276.

Anatomical characteristics

Root anatomy: The epidermis is composed of a single layer cells. It is covered with a thin or thick cuticle. There is 1-2-layered exodermis under the epidermis. The cortex located immediately under the exodermis, is usually 5-6-layered and consists of large hexagonal or polyhedral parenchymatous cells. Endodermis located under the cortex tissue and are ovoid or rectangular cells. There is caspary bundle in anticline (radial and transverse) walls of endodermal cells. Peryscl is below the endodermis. Central part has vascular bundles with clearly differentiable xylem and phloem. Metaxylem is located in the centre of vascular bundle (Fig. 6, 8, 10, 12, 14 and 18).

Leaf anatomy: In the cross-section of the leaves, the cuticle is on the outer layer and it was determined that the upper and lower epidermis layers are similar (Fig. 16 and 17). Epidermis cells are isodiametric and oval. Outside walls are thicker than internal and lateral walls. Both epidermal surfaces are covered with thick or thin cuticle. Cuticle of the upper epidermis is more undulate than the lower epidermis. Stomata is anomocytic type (Fig. 16 and 17) and it is located on slightly higher from the epidermal cells level. Leaf is isolateral. Palisade



Fig. 6: *Colchicum crocifolium*; Cross-section of root, ep-Epidermis, ex: Exodermis, co-Cortex, en-Endodermis, ph-Phloem, xy-Xylem

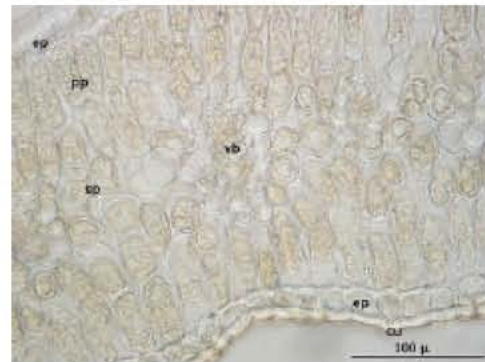


Fig. 9: *Colchicum szovitsii*; Cross-section of leaf; cu-Cuticula, ep-Epidermis, pp-Palisade parenchyma, sp-Spongy parenchyma, vb-Vascular bundle

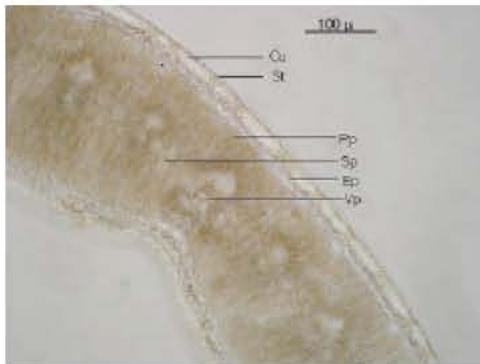


Fig. 7: *Colchicum crocifolium*; Cross-section of leaf; cu-Cuticula, ep-Epidermis, st-Stomata, pp-Palisade parenchyma, sp-Spongy parenchyma, vb-Vascular

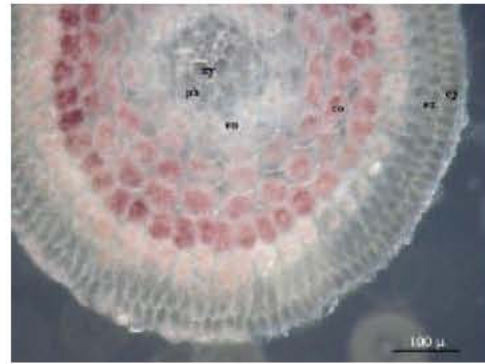


Fig. 10: *Colchicum cilicicum*; Cross-section of root, ep-Epidermis, ex: Exodermis, co-Cortex, en-Endodermis, ph-Phloem, xy-Xylem

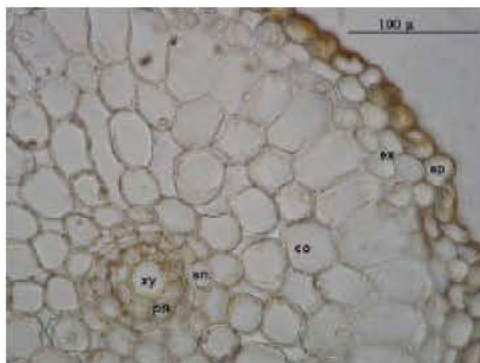


Fig. 8: *Colchicum szovitsii*; Cross-section of root, ep-Epidermis, ex: Exodermis, co-Cortex, en-Endodermis, ph-Phloem, xy-Xylem, vb-Vascular bundle

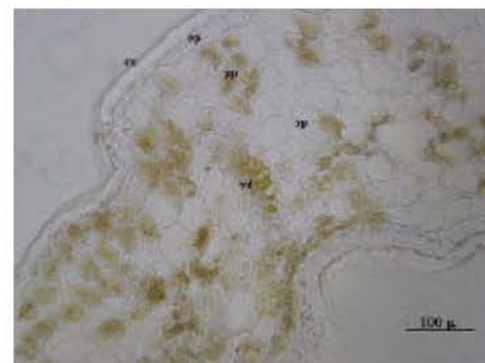


Fig. 11: *Colchicum cilicicum*; Cross-section of leaf; cu-Cuticula, ep-Epidermis, pp-Palisade parenchyma, sp-Spongy parenchyma, vb-Vascular bundle

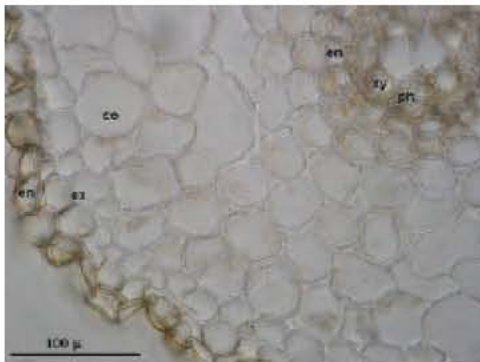


Fig.12: *Colchicum serpentinum*; Cross-section of root, ep-Epidermis, ex: Exodermis, co-Cortex, en-Endodermis, ph-Phloem, xy-Xylem

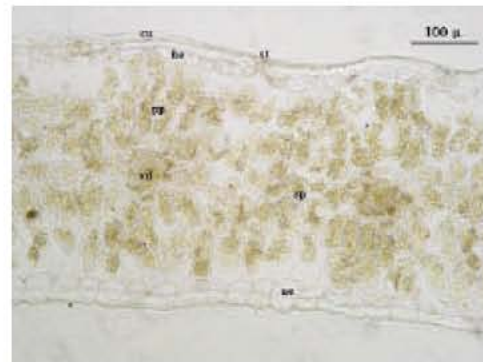


Fig.15: *Colchicum persicum*; Cross-section of leaf; cu-Cuticula, ue-Upper epidermis, le-Lower epidermis, st-Stomata, pp-Palisade parenchyma, sp-Spongy parenchyma, vb-Vascular bundle

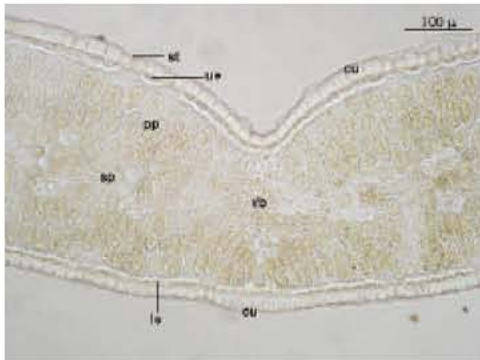


Fig.13: *Colchicum serpentinum*; Cross-section of leaf; cu-Cuticula, ue-Upper epidermis, st-Stomata, pp-Palisade parenchyma, sp-Spongy parenchyma, vb-Vascular bundle, le-Lower epidermis

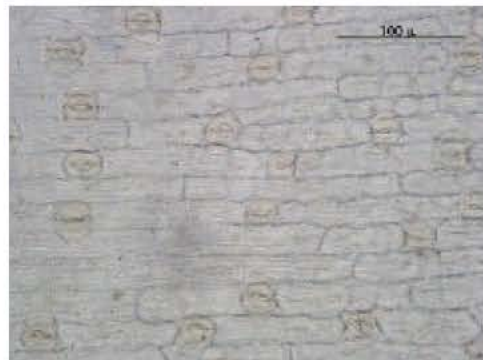


Fig.16: A view of the stomata from upper epidermal peelings of *Colchicum crocifolium*

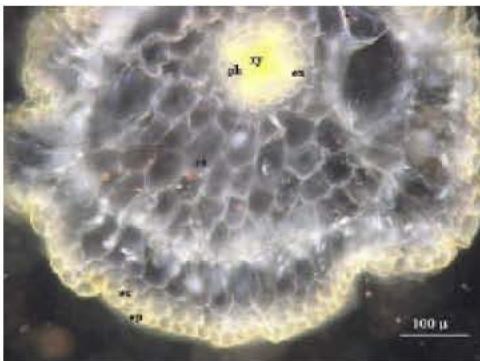


Fig.14: *Colchicum persicum*; Cross-section of root, ep-Epidermis, ex: Exodermis, co-Cortex, en-Endodermis, ph-Phloem, xy-Xylem



Fig.17: A view of the stomata from lower epidermal peelings of *Colchicum crocifolium*

Table 1: The comparison of morphological characteristics between our study and Flora of Turkey, with respect to *Colchicum crocifolium*, *C. serpentinum*, *C. cilicicum*, *C. szovitsii* and *C. persicum*

Morphological characters	<i>C. crocifolium</i>		<i>C. szovitsii</i>		<i>C. cilicicum</i>		<i>C. serpentinum</i>		<i>C. persicum</i>	
	Flora of Turkey	The findings of this study	Flora of Turkey	The findings of this study	Flora of Turkey	The findings of this study	Flora of Turkey	The findings of this study	Flora of Turkey	The findings of this study
Corn (cm)	Not recorded	2-3.5x(0.7-1-2.5)	1.5-4x1-3	1.5-4x1-3	4-6X3-4.5	(3-) 3.5-5.5 (-6)x2.5-4 (-5)	(2-)3-4	2-4x1-2	(3.5-)5-7.5x	3.5-7.5
Leaves numbers	Not recorded	3-30	2-3	2-3	4-5	3-4 (rarely 5)	3-4 (-6)	3 (-4)	5-10 (-13)	5-10 (-13)
Leaves length x width	Not recorded	7-18x 1.5-11 cm	(12-) 16-21 (-25) x(1-)	(12-) 16-21 (-25) x(1-)	30-40x (4-) 5.5-7 (-11.5) cm	17-30 (-40) x(2.5-) 4-7 (-10) cm	9-15 (-20) cm x1-3 (-7) mm	9-15 (-20) cm x 1-4 (-7) mm	7-15x0.4-3 (-3.5) cm	7-15 x 0.4-2 (-3.5) cm
Perianth segments	Not recorded	1-2,5 cm x 1-5 (-7,5) mm	(2.1-) 2.7-3.5 cm x4-10 mm	(2-) 2.4-3 (-3.5) cm x 3-10 mm	(4-) 5-7.5 x1.2-2.5 cm	(2,5-) 3-7.5 x(0.5-) 0.7-2.5 cm	1.3-2.5 cm x 2-4 (-6) mm	1.1-2.5 cm x 2-5 (-6) mm	(2.4-) 2.8-5 cm x5-13 (-19) mm	(2.4-) 2.8-5 cm x 5-13 (-19) mm
Fruit (capsule)	Not recorded	3.5 (-4) x 1.5-2.2 cm	3.5 (-4) x 1.5-2.2 cm	1.5-3 cm,	3-4x 2-2.5	2.5-5.5x 1.5-3 cm	1-1.5 (-2) cm x8-12 mm	1-1.5 (-2) cm x 8-12 mm	(1.5-) 2.5-5 x 0.8-1.8 cm	(1.5-) 3-5 x0.8-1.8 cm

Table 2: The comparison of anatomical characteristics of root in *Colchicum crocifolium*, *C. serpentinum*, *C. cilicicum*, *C. szovitsii* and *C. persicum*

Anatomical characters	<i>C. crocifolium</i>	<i>C. szovitsii</i>	<i>C. cilicicum</i>	<i>C. serpentinum</i>	<i>C. persicum</i>
Exodermis	1-2-layered	1-2-layered	1-2-layered	1-2-layered	1-2-layered
Cortex	5-6-layered	4-5-layered	5-6-layered	4-5-layered	5-7-layered
Raphide crystal	Present	Absent	Absent	Absent	Absent
Casparly bundle	Indistinguishable	Distinguishable	Distinguishable	Distinguishable	Distinguishable
Xylem	Pentarch	Triarch	Triarch	Tetrarch	Tetrarch

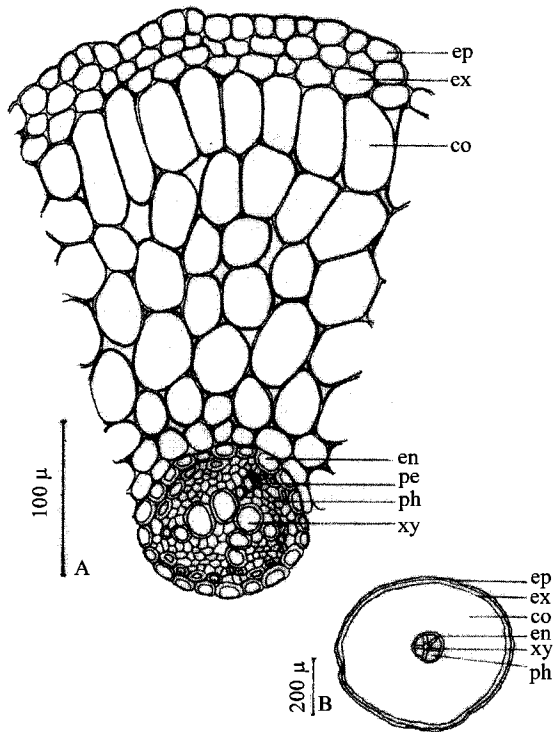


Fig. 18: *C. persicum*, A-B) Cross-section of root ep-Epidermis, ex: Exodermis, co-Cortex, en-Endodermis, pe-Peryscl, xy-Xylem and ph-Phloem

parenchymatic cells are 1-2-layered and usually 2-layered, with chloroplasts in abundance. Spongy parenchymatic cells are 2-3-layered. The vascular bundle is collateral type. The xylem is towards the upper surface and the

phloem towards the lower surfaces (Fig. 7, 9, 11, 13, 15 and 19).

DISCUSSION

In this research, the morphological characteristics of *Colchicum crocifolium* Boiss., *C. serpentinum* Woron. ex Misch., *C. cilicicum* (Boiss.) Dammer, *C. szovitsii* Fisch. and Mey and *C. persicum* Baker were observed. The findings were compared with the Flora of Turkey and it was determined that the findings mainly are parallel to the descriptions in Flora of Turkey. However, there are some minor differences between the findings of this study and the "Flora of Turkey". These are given in Table 1. With the knowledge brought out with this study, the description of species is widened and findings are generally contributed to the Flora of Turkey.

After a comparison of selected characters between Flora of Iraq^[25], Flora of Iran^[23] and our findings for *Colchicum crocifolium* Boiss., it was firstly determined that there are some major variations on the view point of leaf numbers, flower numbers and flower colour. In our findings the leaf numbers have been observed between 3 and 30 and flower numbers up to 30 whereas in Flora of Iraq, the leaf number is up to 20, the flower numbers are between 1 and 6; in Flora of Iran, the leaf number is between 6 and 14 and flower number is between 4 and 12. Therefore, it can be seen that the specimens in Turkey show differentiation from that of Iran and Iraq. It was realized that *C. crocifolium* on the view point of the leaf and flower numbers show variations according to habitats and ecological conditions.

Table 3: The comparison of anatomical characteristics of leaf in *Colchicum crocifolium*, *C. serpentinum*, *C. cilicicum*, *C. szovitsii* and *C. persicum*

Anatomical characters	<i>C. crocifolium</i>	<i>C. szovitsii</i>	<i>C. cilicicum</i>	<i>C. serpentinum</i>	<i>C. persicum</i>
Cuticle	Thick	Thin	Thick	Thick	Thick
Stomata type	Anomocytic	Anomocytic	Anomocytic	Anomocytic	Anomocytic
Leaf type	Isolateral	Isolateral	Isolateral	Isolateral	Isolateral
Palisade parenchyma	1-2-layered	1-2-layered	1-layered	2-3-layered	2-layered
Spongy parenchyma	2-3-layered	2-3-layered	2-3-layered	2-3-layered	2-3-layered
Vascular bundle type	Collateral	Collateral	Collateral	Collateral	Collateral

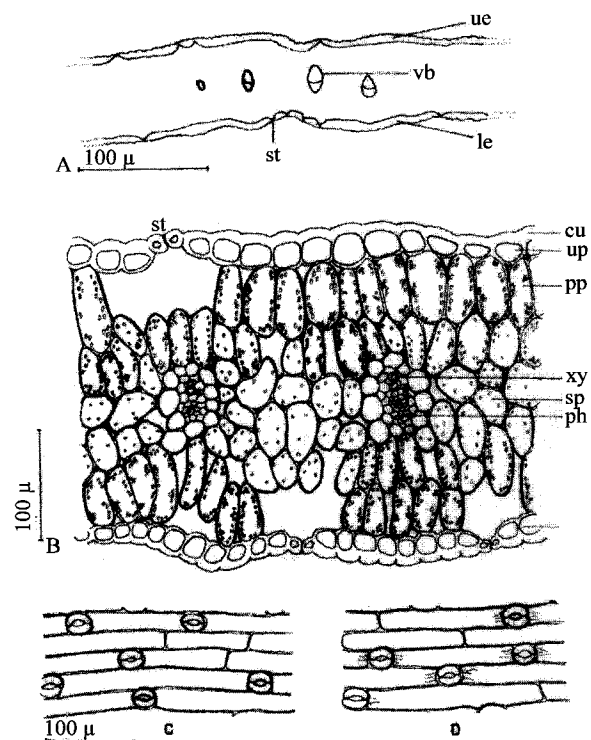


Fig. 19: *Colchicum persicum*, A-B) Cross-section of leaf, C) upper epidermis of leaf, D) lower epidermis of leaf; cu-Cuticula, ue-upper epidermis, le-Lower epidermis, st-Stomata, vb-Vascular bundle, pp-Palisade parenchyma, sp-Spongy parenchyma, xy-Xylem, ph-Phloem

In this research, the morphological and anatomical features of *Colchicum crocifolium* Boiss., *C. serpentinum* Woron. ex Misch., *C. cilicicum* (Boiss.) Dammer, *C. szovitsii* Fisch. and Mey and *C. persicum* Baker were studied in order to provide a more detailed description for the future studies. Moreover, with this study, the determination of the anatomical characteristics present the first data available in the literature.

The anatomy of *Colchicum* based on the leaf anatomy was studied and concluded that there is no important difference between the species.

The cortex in root is usually 5-6-layered in studied *Colchicum* sp. and the first row of the cortex of

C. crocifolium contained raphide crystals (Fig. 6) whereas the other species lacked them (Table 2).

The caspary bundle in the endodermis is only indistinguishable in *C. crocifolium*, it is distinguishable in the others *Colchicum* sp. given in this study.

Different number of xylem arms in their roots were observed for each species. The xylem arms are triarch in *C. szovitsii* and *C. cilicicum* and tetrarch in *C. serpentinum*, *C. persicum* and pentarch in *C. crocifolium* (Fig. 6, 8, 10, 12, 14 and 18).

There is a thick layer between epidermis and cuticle in lower surfaces of all the studied *Colchicum* sp., on the contrary upper epidermal surfaces are covered with thin cuticle. It was determined that the upper and lower epidermis cells in leaves are similar size in *C. szovitsii*, *C. cilicicum* and *C. persicum* (Fig. 9, 11 and 15). But, the lower epidermis cells in leaf of *C. serpentinum* and *C. crocifolium* (7, 13) are more small size than upper epidermis (Table 3).

In addition, leaves of all the studied *Colchicum* sp. are isolateral type.

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