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Bioecological Features and Anatomical Structure of *Crocus korolkovii* Regel & Maw in the Introduction of Uzbekistan

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Abstract

The results of the study *Crocus korolkovii* Regel & Maw, were introduced into the Tashkent Botanical Garden. Bioecological features, morphological and anatomical characteristics of *Crocus korolkovii* were studied. Phenology was studied by I.N. Beideman, biology bloom by A.P. Ponomarev, breeding and seed production of plants by T.T. Rakhimova. The study of the biology of flowering determined the optimal humidity, air temperature and soil surface. The anatomic study used fresh tissue samples which were fixed in 70% alcohol. A cross-section of the sheet and the structure of the flower in the introduction of conditions were studied.

Keywords

Crocus korolkovii Regel & Maw, Introduced, Morphological and Anatomical Characteristics, Phenology, Flowering Biology, Conditions

1. Introduction

Ornamental plants of natural flora allow you to set the adaptive capacity of species in a particular habitat. The process of introduction is clearly consistent with the spatial and temporal relations of the form of life. This link genotype is fixed and has the phenotypic expression of morphological variability biomorphs, features of its reproduction, ontogeny and decorative qualities [1].

Crocuses are one of the most beautiful early-flowering plants. In the world there are about 80 species that are common in Europe and the Mediterranean in Asia. 19 species grow within the borders of the CIS [2].

Crocus korolkovii Regel & Maw is a crocus (saffron) from the family of Iris or Iridaceae Juss. One of the representatives of mountain and foothill grasslands of Central Asia is Jungar Alatau.

Crocus korolkovii was described in 1880 by two authors (G. Maw and EL Regel) on fees from the Northern foothills of Uzbekistan (between Tashkent and mountains Karakata), included in the Red Book of Kazakhstan [3].

Many species of the family *Iridaceae* grow in parks and gardens as an ornamental plant because of their beautiful colors [4]. Some types of Crocus L. were used for the preparation of dyes, perfumes and medicines back in 1600 BC. F. Abdullayev (2003) pointed out that saffron may be useful in chemoprevention of cancer in the near future [5]. Morphological features of *Crocus alatavicus* Regel et Semen and *Crocus korolkovii* Regel & Maw in Tashkent conditions were studied by AH Sharipov [6]. Canan Ozdemir (2004) studied the anatomical structure of the *Crocus flavus* Weston subsp [7]. Anatomical studies on *Crocus korolkovii* Regel & Maw were not carried out.

The purpose of the study is to introduce, identify and select the most decorative and resistant species, creating decorative and medicinal plantation crocuses in Uzbekistan.

2. Materials and Methods

Or Saffron (*Crocus korolkowii*), corm almost spherical, up to 1.5 cm in height and 2 cm Chiron, with webbed unclear mesh, reddish scales. Leaves (5 - 15) appear during flowering, narrow-linear, grooved, with a white stripe down the middle. Flowers are solitary or in 2 - 5, with a funnel-shaped perianth of 6 identical leaves, adherent in a long tube. The color of flowers is bright, yellow-orange, outside shiny purple. Stamens three, they are half as long as tepals, with orange, not diverging from the tops of anthers. The fruit is oblong box, about 1 cm wide, appears on the surface only after maturation. Flowering is in February and May, fruiting in May-June.

C. korolkowii introduced from the Pamir-Alai Range (Baysuntau) to Tashkent (Botanical Garden F.N. Rusanov.). In the first year we studied bioecological features only plants under natural conditions. In the second year of the study studied phenology, flowering biology, breeding, seed production and the anatomical structure of the plant with the introduction of conditions.

Phenology was studied by I.N. Beideman [8], the biology of flowering by A.P. Ponomarev [9], seed production by T.T. Rahimova [10]. The anatomical work was carried out using fresh tissue samples fixed in 70% alcohol.

The introduction of conditions tubers planted at 8 cm apart and 10 cm depth, with aisles of 40 cm. The vegetation of the underground parts of the plant began in the II-III decade of October. The diameter of the bulbs 1.5 - 2 cm, the number of roots 52 - 55 pcs., Root length 4 - 4.5 cm. The height of the underground parts of plants is 4.5 - 5.5 cm, sprout 4 - 4.5 cm length, width 0.5 mm (**Figure 1**).

Vegetation starts in the underground part of the second decade of February. Plant height of 6 - 8 cm above-ground portion of 1.5 - 2 cm. Diameter follicles 2 - 2.5 cm, the number of roots 55 - 60 pcs., Length of roots 4.5 - 5 cm (**Figure 2**).

Figure 1. The underground part of *C. korolkowii*.

Figure 2. The above-ground part of the *C. korolkovii*.

Figure 3. Flowers *C. korolkowii*.

Leaves of *C. korolkowii* are in an amount of 8 - 11, narrow, dark green, with a white longitudinal stripe in the center. Flowers 1 - 4, narrowly form. Tepals are white, until the middle (internal to the base), together with the tube streak purple, yellow at the base. Stamens are nearly 2 times shorter than the tepals (Figure 3, Table 1 & Table 2).

Regrowth of the leaves and the appearance of buds in *C. korolkowii* in Tashkent conditions observed in the second decade of January, February, sometimes depending on the weather conditions of the year. The earliest flowering noted,

on February 14 the most later than 3 March. Flowering ends in II-III decade of March. Fruiting occurs in late April - early May. The end of the growing season occurs in the first half of May. The duration of the growing season is of 96 - 158 days (Figure 4).

Table 1. Structural indicators base sheet *Crocus korolkowii*.

Indicators	*Crocus korolkowii*
The epidermis: height	25.46 ± 0.24
The epidermis: width	16.12 ± 0.41
the thickness of the outer wall	6.94 ± 0.16
palisade cell: height	39.97 ± 0.65
palisade cell: width	19.26 ± 0.20
Index palisade	2.5
Amount of rows	Leaf base −3 The side parts −3
The number of rows of palisade cell layer	2 row 3 row
The number of vascular bundles	2 + 6
The diameter of the vessel. height	12.49 ± 0.51
The diameter of the vessel. width	14.44 ± 0.43

Table 2. Comparative analysis of *Crocus korolkowii* bodies.

№	evidence	*C. korolkovii*
1	Form sheet	Narrowly linear smooth, green
2	leaf length	12 - 16 cm
3	A cross section shape of the base sheet	Flattened, triangular, side of the boundary edges of the extended
4	Type mesophyll	Izolaterial-palisade
5	Garden number of rows of cells (base, middle, upper)	3 3 3
6	Sklerifikatsiya vascular bundles	Poor
7	sheet Parenhimation	Medium, wall winding
8	The structure of the stigma	Whole
9	The structure of the perianth	Lanceolate or oblong

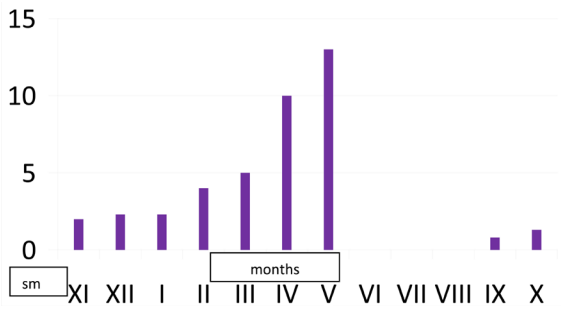

Figure 4. Phenology *C. korolkowii* in the introduction of conditions (Botanical Garden F.N. Rusanov).

In nature, *C. korolkowii* blooms in February and March, in Tashkent under flowering phase had shifted to an earlier time (2 - 3 weeks).

In the study of the biology of flowering *C. korolkovii* defined optimal humidity, air temperature and soil surface (Figure 5).

In nature, *C. korolkowii* fruiting in May-June, *i.e.* in a phase of fruition in Tashkent had shifted to an earlier time (2 - 3 weeks). Under Tashkent conditions *C. korolkovii* seeds are formed in the second decade of April. The term of the formation of the seeds is about 7 - 8 days. 22 - 28 pieces are formed in each box. Seeds, 0.3 - 0.5 mm in size (Figure 6). Seed production figures are shown in Table 3.

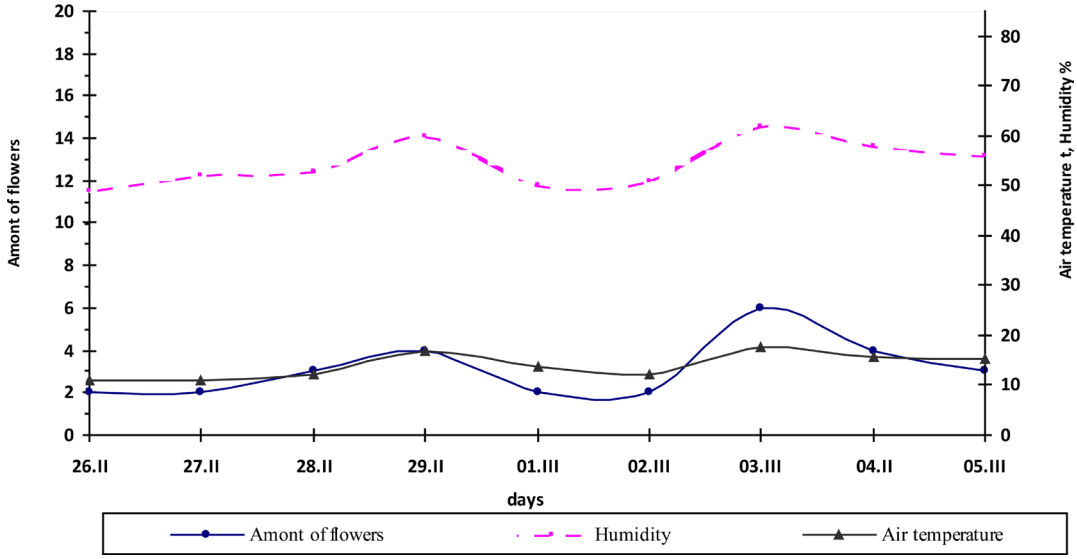

Figure 5. Biological flowering *C. korolkowii* in the introduction of conditions (Botanical Garden F.N. Rusanov).

Figure 6. The seeds of *C. korolkowii* in the introduction of conditions (Botanical Garden F.N. Rusanov).

Table 3. Seed production *C. korolkovii* in terms of introduction (Botanical Garden F.N. Rusanov) n = 10.

Indexes	Condition	
	In nature (Baysun)	Tashkent (Botanical Garden)
The diameter of the corms, sm	1.76 ± 0.07	1.69 ± 0.07
The length of the stem, sm	9.4 ± 0.40	8.5 ± 0.40
Number of leaves, pcs.	9 ± 0.58	8.2 ± 0.51
The length of the leaf, sm	18.5 ± 1.05	17.5 ± 0.89
The length of the boxes, sm	2.15 ± 0.05	2.04 ± 0.04
The diameter of the boxes, sm	1.67 ± 0.06	1.57 ± 0.06
PSP pcs	23.3 ± 0.65	21.9 ± 0.60
RSP pcs	17.1 ± 0.57	15.4 ± 0.65
CSP %	73.4 ± 2.90	70.3 ± 3.09

3. Anatomical Features

Samples of plants (*C. korolkowii*) were collected in the experimental section of the Tashkent Botanical Garden. The anatomical work was carried out using fresh tissue samples fixed in 70% alcohol.

The base sheet cross-section is flattened, triangular, with obtuse angles. The surface of the keel smooth, rounded edges, the side edges of the sheet edge enhanced adaxial part of the concave. The epidermis thick-walled large-keel (**Figure 7(a)** & **Figure 7(b)**).

Mesophyll keel consists of 3 rows of cells relatively small garden, which are located between two large and one small vascular bundle (**Figures 7(d)-(f)**). Close vascular bundle consists of 20 - 25 vessels, and phloem, is a group of bundles of sclerenchyma cells (**Figure 7(c)**).

The side of the base plate consists of a single row of relatively small thick-walled epidermal cells of the epidermis, which is located under the 3 row palisade tissue. In both side portions are large by conductor bundle 3 (**Figure 7(f)**).

Between the beams are located in the middle of the sheet winding with parenchymal cell walls.

The middle of the sheet in a cross section clearly triangular, smooth wing surface side of the leaves are trifoliate-grooved has a similar structure to the leaf base, but differs in the number of vascular bundles (13-14), the size and density of palisade cells (**Figure 8(a)** & **Figure 8(b)**). Parenchymal cells in the middle portion occupy a large area (ris.7a.b.f.). Groups of sclerenchyma cells above the beams, less thick (**Figures 8(b)-(d)**).

The top of the sheet is different from the base and middle of the following indicators: leaf blade narrow cuticular layer of the epidermis papillary, large-, palisade cells are large, elongated and arranged more densely, small vascular bundles sklerification (8-9) (**Figures 9(a)-(d)**).

Thus, *Crocus korolkovii* strongly expressed palisade parenchyma in the base plate occupies a larger area than in the middle and at the top. Conductive beams sklerification less, the number of vessels in the beams more.

4. The Structure of the Flower

In an amount of 1 - 5 flowers, tepals are yellow-orange on the outside (internal only at the base) together with a tube with a streak of purple stain, lanceolate or oblong, acute or obtuse, 15 - 20 mm long, 3 or more times as long as tube. Stamens are 2 times shorter than the tepals, with orange anthers. Stigmas whole. Capsule oblong, 8 - 9 mm wide. The cross section of the stigma 3-lobed, curved oval shape (Figure 10(b)). Small in size. Staminate thread slightly rounded with a recess, covered with rare or single-celled hairs (Figures 10(b)-(f)). Staminate thread consists of 4 - 8 rows of parenchyma, located in the center of one vascular bundle with two small vessels (Figure 10(c)).

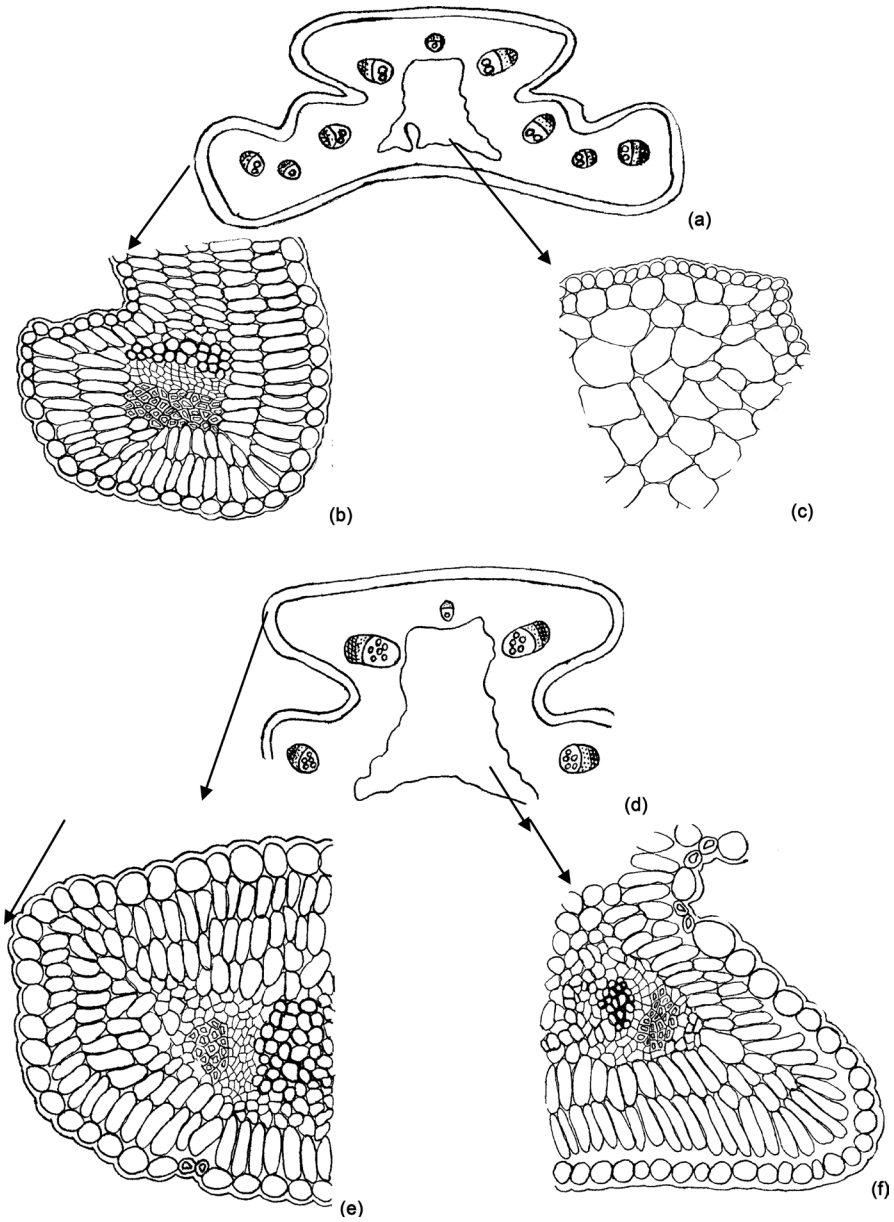

Figure 7. A cross section of the base of the leaf *Crocus korolkowii*. (a) Diagram of the base sheet; (b) Left lower lip; (c) Parenchyma; (d) Circuit keel; (e) Left protrusion of the keel; (f) Right protrusion of the keel.

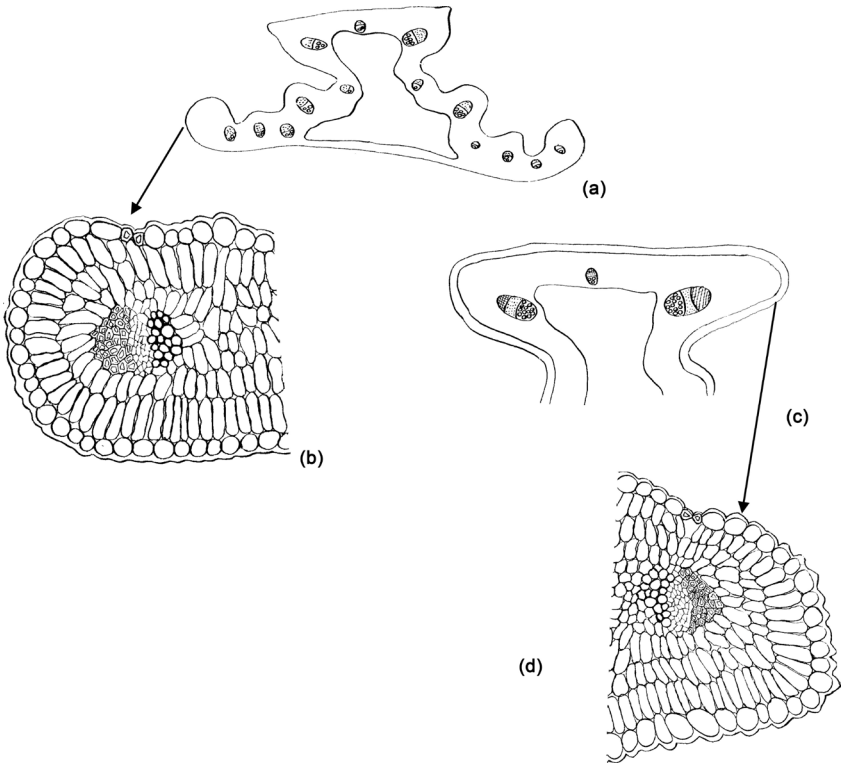

Figure 8. A cross section of the middle layer sheet *Crocus korolkowii*. (a) Mid-circuit sheet; (b) Left lower lip; (c) Diagram of the keel; (d) Right protrusion of the keel.

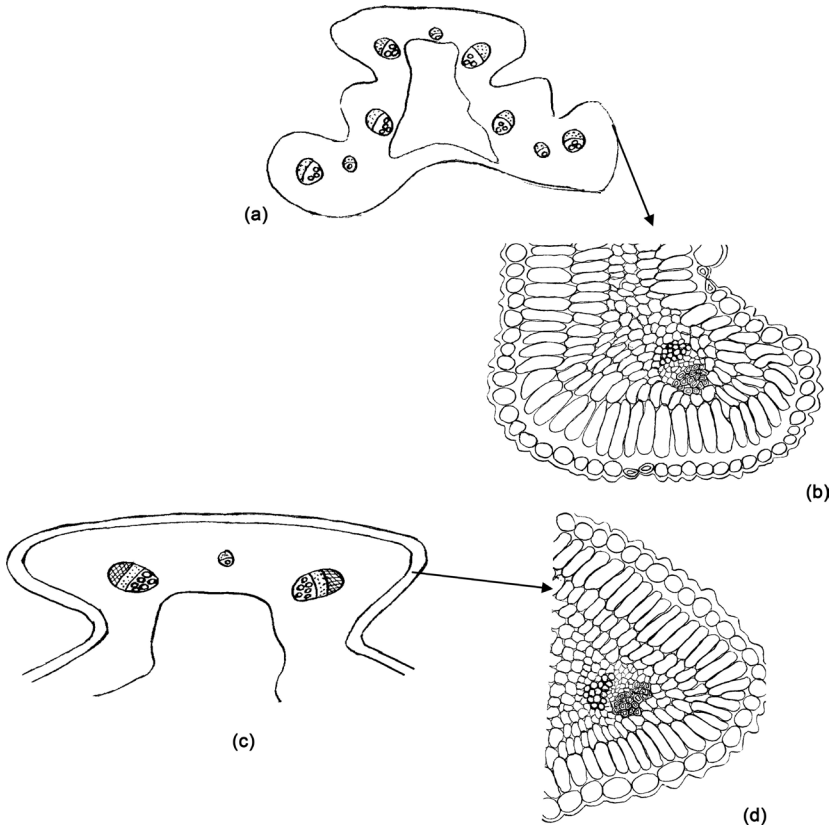

Figure 9. A cross section of the upper tier leaf *Crocus korolkowii*. (a) Diagram of the top; (b) Right lower lip; (c) Diagram of the keel; (d) Right protrusion of the keel.

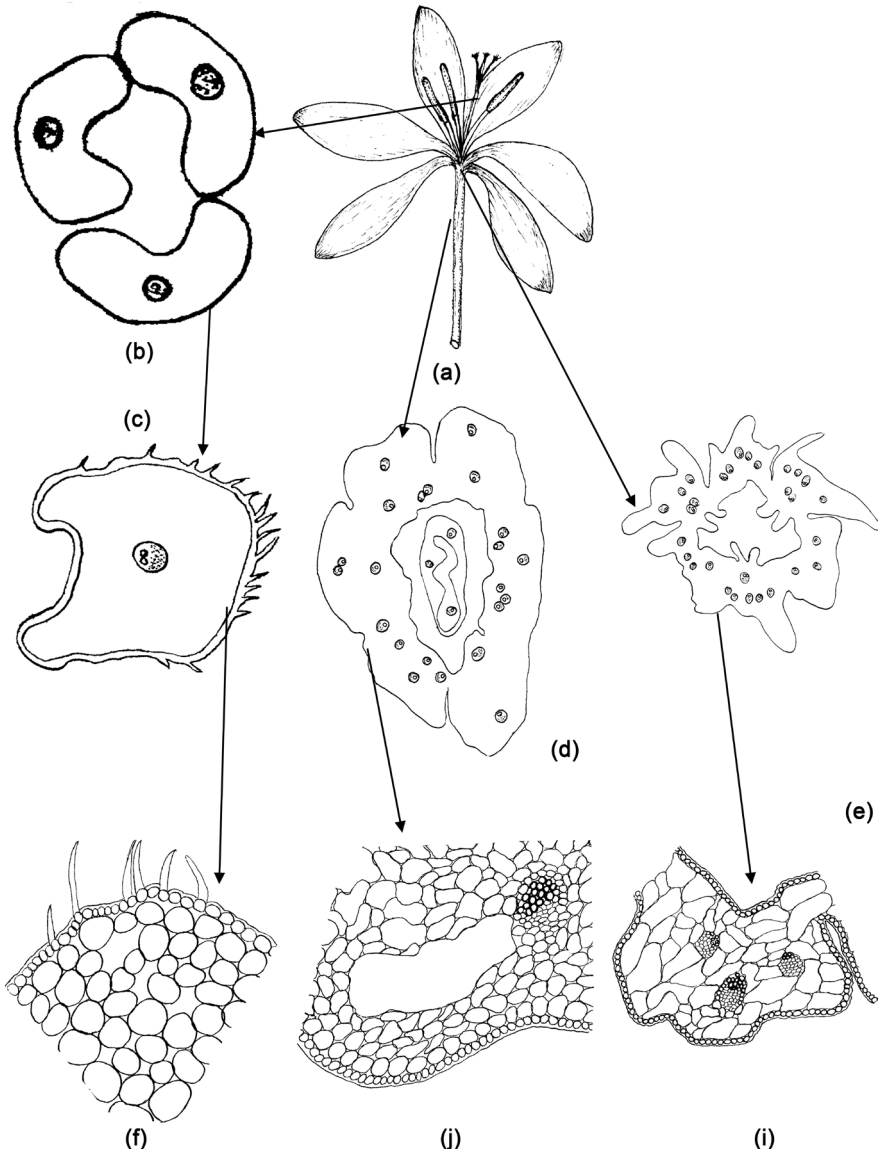

Figure 10. The structure of the flower *Crocus korolkowii*. (a) General view of a flower; (b) Diagram of a cross section of the stigma; (c) Diagram of the base of the stigma; (d) detail of stigma; (e) Diagram of the perianth tube; (f) Circuit the top of perianth tube; (j) Scheme basis perianth tube; (i) Detail of the top of the perianth tube.

A cross section of anther consists of two layers, the inner and outer epidermal fibrosus. Epiderm is papillary larger (Figures 11(a)-(c) & Figure 11(f)). The tube is at the top of the 6-lobed, parenchymal. The parenchyma consists of 3 - 7 rows of crushed cells of different sizes (Figure 10(j) & Figure 10(i)).

In mid-parenchymal cells are numerous small vascular bundles with 5 - 8 vessels. The epidermis is of the tube small cell (Figure 10(i)).

In the middle part of the perianth tube is oval, slightly winding (Figure 10(d) & Figure 10(e)). Thin-walled parenchyma small cell partially destroyed it. In the center there are several lined parenchyma vascular bundles, non-oriented arrangement.

Thus, three-lobed stigma, its structure parenchymal, perianth tube in a cross

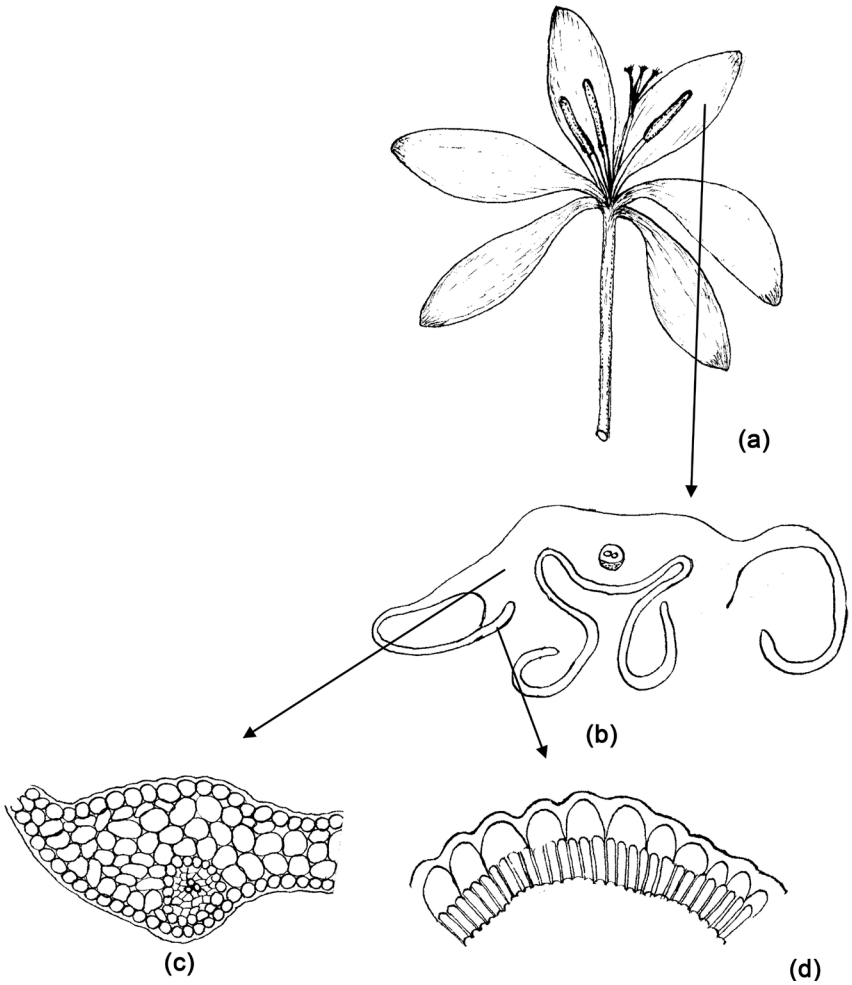

Figure 11. The structure of the flower *Crocus korolkowii*. (a) General view of a flower; (b) Base circuit anther; (c) Detail right hand anther; (d) Piece boot.

section of triangular shape, smaller than the number of *C. sativus* L. conductive beams 21 - 22 [11]. Perianth walled parenchyma with small vascular bundles.

5. Conclusions

In Tashkent conditions *C. korolkovii* is successfully grown without irrigation, often forming a self-seeding. Vegetative reproduction is weak. Mature plants are competitive to local weeds, resistant to pests and diseases.

In the context of the introduction of the vegetation, starting from II-III decade of October, flowering begins in the second decade of January, sometimes the first decade of January. Duration of flowering is about 12 - 18 days. Vegetation ends first, sometimes the second decade of April. Duration growing season is 96 - 158 days.

Studies of anatomical structure showed that *C. korolkovii* has 3-lobed stigma, the structure of parenchymal, perianth tube in a cross section of triangular shape, smaller than that of other types of Crocus, for example, *C. sativus* L. [11]. The number of vascular bundles is 21 - 22. Perianth walled parenchyma with small vascular bundles.

Thus, the cold weather in late winter and early spring periods delays the onset of flowering and high temperatures during flowering accelerate it. Similar results were observed with the introduction of plants of other species, such as *Eremurus*.

Successful cultivation of this kind of culture will enrich the range of early-flowering plants used in green building, maintained in culture plants, made in the "Red Book".

Thus, the successful cultivation of this kind of culture will enrich the range of ornamental plants used in landscaping.

References

[1] Sedelnikova, L.L. (2011) Ontogenez *Crocus alatavicus* in Siberia. *Bulletin of Voronezh State University*, №2, 75-76.

[2] Tsitsin, N.V. (1960) Ornamental Perennials (Brief Introduction of Results). p. 27.

[3] Ivashchenko, A. (2005) Tulips and Other Bulbous Plants in Kazakhstan. Two Capitals, Almaty, 192 p.

[4] Baytop, T. (1984) Torkiye'de Bitkiler ile Tedavi. (Gegmiflte ve BugOn). Istanbul, 40 p.

[5] Abdullaev, F.L. (2003) *Crocus sativus* against Cancer. *Archives of Medical Research*, **34**, 354. https://doi.org/10.1016/S0188-4409(03)00048-1

[6] Sharipov, A.K. (1991) Introduction and Acclimatization of Plants—Introduction Central Asian Species of Saffron (*Crocus* L.) in the Conditions of the Botanical Garden. Publishing House "Fan". Tashkent, Vol. 24.

[7] Ozdemir, C., Akyol, Y. and Algtepe, E. (2004) Morphological and Anatomical Studies on Endemic Two Crocus Species of Turkey Area. *Pakistan Journal of Botany*, **36**, 103-113.

[8] Beideman, I. (1974) Methods of Studying Plant Phenology and Rastitelnyh Communities. USSR Academy of Sciences, Moskva, 84-86.

[9] Ponomarev, A.N. (1960) Study of Flowering and Pollination. Field Geobotany. Lavrenko, E.M. and Korchagin, A.A., Eds., AN SSSR, 9-11.

[10] Rakhimov. T.T. (2009) Plant Ecology and Fitocenology. Tashkent, 11.

[11] Makhmudov, A.V. (2016) Bioecological Features and anatomical Structure *Crocus sativus* L. to the Introduction in Uzbekistan. *Journal of Novel Applied Sciences*, **5**, 17-23.