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Introduction of *Colchicum autumnale* L. in the Conditions of the Botanical Garden of the National University of Uzbekistan (Tashkent City)

Khamid Yarashevich Azizov[1], Tashkhanim Tuymukhammedovna Rakhimova[2], Nargiza Kamiljanovna Rakhimova[3*]

[1]Department of Botany and Genetics of the National University of Uzbekistan, Tashkent, Uzbekistan
[2]Laboratory Geobotany of the Institute of Botany of the Academy of Sciences, Tashkent, Uzbekistan
[3]Laboratory Dendrology of the Tashkent Botanical Garden Named after Academician F.N. Rusanov, Institute of Botany of the Academy of Sciences, Tashkent, Uzbekistan
Email: *nargizarah1980@mai.ru

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Abstract

For the first time, the biological features (morphological features of vegetative and generative organs) of 8-year-old *Colchicum autumnale* were studied in the conditions of the introduction of the botanical garden of the National University of Uzbekistan. The biological feature of the studied species is its flowering in autumn, and the fruits are formed in the spring of the following year, from underground ovaries. In our conditions in Tashkent, fruit ripening was observed at the age of two in the first decade of July. The studied species has adapted well (blooms abundantly and forms fruits) to the new place of growth. It should be noted that in many places of the city of Tashkent, the fruits of the plant do not form. However, in the cultural conditions of the botanical garden of the National University of Uzbekistan, fruits and seeds were formed annually, which is the success of the introduction.

Keywords

Tashkent, Uzbekistan, *Colchicum autumnale*, Introduction, Growth and Development, Flower, Corm, Boll, Fruit

1. Introduction

Scientific research works aimed at studying morphological, ecological, physiological, etc. are conducted in the world practice. Features of promising medicinal

plants common in various environmental conditions and used in medicinal and ornamental gardening, as well as their conservation and reproduction by introduction into local conditions. Currently, much attention is being paid to the adaptation of plants of foreign flora in local conditions, as well as the creation of industrial plantations, which is one of the urgent tasks. Based on these tasks, the peculiarities of growth and development, the determination of the biology of flowering and phytochemical composition, the assessment of introductions, as well as the increase and creation of plantations of introduced species are important. Such promising plants include the genus *Colchicum* L., which is a group of bulbous plants. The genus *Colchicum* belongs to the evergreen family Colchicaceae, which includes 65 species distributed in the temperate zone of the Mediterranean. There are 12 species within the CIS, of which 8 grow in the Caucasus, 2 in the European part of Russia, and 2 in Central Asia. It has many garden forms and varieties [1].

According to POWO 2025 [2], 13 species of evergreen are found in the CIS today: *Colchicum autumnale*, *C. falcifolium*, *C. arenarium*, *C. kesselringii*, *C. laetum*, *C. luteum*, *C. szovitsii subsp. szovitsii*, *C. speciosum*, *C. szovitsii*, *C. triphyllum*, *C. umbrosum*, *C. woronowii*, *C. freynii.* The distribution range of the genus is very extensive. In natural conditions, evergreens grow on plains and in mountains, rising up to 3 thousand m above sea level, in steppes, shrubby mid-Sea formations, in forests (mainly mountainous), on meadows in the Mediterranean, Near Asia and the Caucasus; Some species are found in Western Europe, the southern regions of the European part of the former USSR, and in Central and Central Asia [3].

All species belong to valuable highly decorative representatives of the Western European flora. Alkaloids have been found in the generative organs of the evergreen, among them colchamine and colchicine, used in oncology [4]. The medicinal raw materials are fresh whole corms harvested during the flowering period of the plant. The raw materials are used fresh to produce the alkaloid colchamine, to a lesser extent colchicine [5]. These alkaloids are used in the treatment of gout and rheumatism, as well as bronchial asthma, jaundice, dropsy, intestinal and kidney diseases. Evergreen is also considered a protective agent against contagious diseases, especially the plague [6]. All parts of plants are very poisonous [7]. The alkaloids (colchicine and colhamine) of *Colchicum autumnale* are karyoplastic poisons, that is, they can cause the decay of nuclei in various cells of the body. The main source of colchicine today is *Colchicum autumnale*.

There are 2 species of evergreen found in Uzbekistan: *Colchicum luteum* and *C. kesselringii*. In *Colchicum luteum*, the corm is ovate-oblong, 10 - 30 mm wide, clothed with brown, b. m. leathery shells, the leaves are 2 - 3, linear, 7 - 30 mm wide. The flowers are 1 - 3 in number. The tepals are yellow, sometimes with a purple tinge, lanceolate. The box is broadly oblong, 2 - 3.5 cm long with nests pointed at the tip. It blooms in late March and July, and bears fruit in April and August [8]. It grows on rocky and fine-grained slopes, near patches of melting snow, from the lower to the upper belt of mountains. It is distributed in Tashkent, Fergana, Samarkand and Bukhara regions. General distribution: Central Asia, Af-

ghanistan, India. The species *C. kesselringii* is endemic to Central Asia with a continuing abundance. A perennial bulbous plant. Leaves 3 - 6, linear. The flowers are 1 - 4 in number, white. It grows on fine-grained and gravelly-fine-grained slopes from the foothill plains to the upper belt of the mountains. It occurs in isolated specimens and small populations. Reproduction is by seed. It is widespread in Tashkent, Samarkand, Navoi, Kashkadarya, Jizzakh and Surkhandarya regions. Outside of Uzbekistan: Kazakhstan, Tajikistan, Kyrgyzstan [9].

Colchicum autumnale grows in fertile soil, in moist and floodplain meadows along rivers and streams, and forms diffusely arranged clusters in habitats [10]. In the Ukrainian Carpathians, the natural population density is approximately 15 - 25 individuals per 1 m^2. It grows in nitrogen-rich soil. It is confined to acidic brown forest and slightly acidic clay soils. It is found in such species as *Centaurea phrygia*, *Campanula glomerata*, *Bellis perennis*, *Trifolium pratense*, *Calina acaulis*, and others [11]. The plant is bulbous, the corm is an underground part, ensuring its survival in adverse periods. It serves as a repository of nutrients, leaves and flowers develop from them, have a rounded or ovoid shape, and are covered with many dry scales throughout the year. In spring, leaves appear from it, which die off by midsummer, and in autumn—the flower of the bulb's dry scales protects it from damage and drying out. Inside, the bulb is filled with reserves of nutrients necessary for the development of the aboveground part of the plant.

2. Material and Methods

The object of the study is the bulbous, medicinal, ornamental plant *Colchicum autumnale* L. from the Colchicaceae family, belonging to the autumn-flowering phenorhythmotype with spring vegetation (**Figure 1**). The bulbs of the research object were obtained from Poland in 2017.

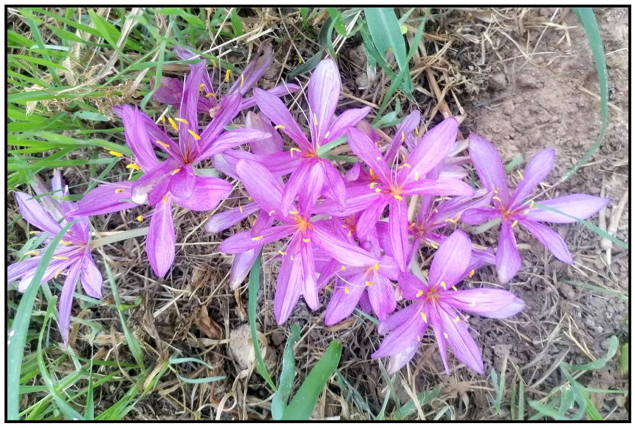

Figure 1. Flowering of *Colchicum autumnale* in the conditions of the introduction of the Botanical garden of the National University of Tashkent (06.09.2025).

The growth and development of the plant during the growing season was noted according to the method of I.N. Beideman [12]; seasonal development by I.V. Borisova [13]; seed productivity by A.A. Ashurmetov & H.K. Karshibaev [14].

In our experiments, the usual method of planting *Colchicum autumnale* bulbs was used. The row spacing is 40 - 45 cm. If the bulbs are large enough, the planting depth will be 10 - 15 cm, with a distance between the bulbs of 20 - 25 cm. Small bulbs were planted to a depth of 5 - 10 cm with an interval of 10 - 13 cm. The soil must be loosened before planting.

The climate of Tashkent is continental, moderately cold with insufficient moisture. According to the Tashkent meteorological station, since 2018, according to the long-term average data, the air temperature has been +16˚C + 17.3˚C, relative humidity (RH)—45.4% - 52.3%, precipitation—425 - 623 mm. precipitation mainly falls in winter and autumn.

3. Results and Discussion

L.L. Sedelnikova [4] studied the biological patterns of development of *Colchicum autumnale* and other bulbous and bulbous species during introduction to the forest-steppe zone of Western Siberia. The phytocenotic features and ontogenesis of *Colchicum fominii* in Ukraine were studied by A.M. Gnatiuk [15]. In Belarus, the genus Colchicum is represented in the collection fund by 7 species, 4 garden forms and 5 varieties [16]. The morphobiological features of *Colchicum autumnale* during introduction in the south of the Central Russian Upland were studied by E.I. Naidenova & N.V. Ospischeva [17]. The dynamics of yields and stocks of the medicinal plant *Colchicum autumnale* in the Ukrainian Carpathians was studied by L.M. Bodnar [11]. In Uzbekistan, the peculiarities of growing *Colchicum autumnale* have also been studied in Tashkent [18]. The taxonomy and systematics of the genus Colchicum L. in Ukraine was studied by A.M. Gnatyuk [19]. A.M. Gnatyuk & L.V. Gurnenko [20] also studied the morphological features of pollen grains of species of the genus *Colchicum* L. flora of Ukraine. D.R. Kabaloeva *et al.* [21] studied a comparative study of microscopic features of corms of the autumn corms and the magnificent corms in Vladikavkaz. Many foreign scientists are also conducting research on the phytochemical composition, biological and medicinal efficacy of *Colchicum autumnale* [22]-[28] (**Figure 2**).

Figure 2. Spring leaves of *Colchicum autumnale* (2025).

August is considered the most optimal month for planting bulbs. It should be noted that the bulbs are large, with a planting depth of 10 - 15 cm. Small bulbs 6 - 10 cm. The soil must be loosened before planting. The research was conducted in 2017-2025. The bulbs were planted in the ground from August 15 - 20, 2017. After 6 - 10 days, flowering was observed in late August and early September. At that time, the average air temperature was +27˚C, and the relative humidity was 31%. Flowering lasted until the first decade of October, *i.e.* 40 - 45 days. Next year, in the spring of 2018. At the end of February, large lanceolate leaves appeared from the bulb.

The seed capsules, located in the perianth tube, along with the leaves are brought to the soil surface in early spring. In April 2019, the second year of vegetation, a green box appeared, 2 - 4 cm long and 1.5 - 2 cm wide. Then, in the middle and end of May, the boxes begin to darken, at the end of June, at an average air temperature of 29˚C and a relative humidity of 33.3%, and in the first decade of July, at an average air temperature of 30.7˚C and a relative humidity of 26.5%, the box fruits ripen. Over time, the boxes dry out and crack. The corms are at rest throughout the summer. In August, the plant begins to bloom anew, but the leaves do not appear. The fruit is dry, with 1 - 2 boxes. The box is 3-sided. The shape is ovoid or oval, fleshy, usually green at first, lightens or turns brown as it matures. The seeds are spherical, brown, and attract ants, which carry the seeds. Weight 1000 pcs. seeds 18 - 19 g (Figure 3). The fruiting rate is 80% - 88%.

(a) (b)

Figure 3. Leaves and green pods (a), seeds and dry pods (b) of *Colchicum autumnale*.

We also studied the morphological features of the vegetative and generative organs of *Colchicum autumnale* from the second to 8 years of age (Table 1).

Table 1. Morphological signs of *Colchicum autumnale* at different ages.

Years of research					
Indicators	***Age*: 2**	**3**	**5**	**7**	**8**
***Years*: 2019**		**2020**	**2022**	**2024**	**2025**
Plant height, cm	18 - 23	14 - 18	20 - 25	20 - 23	18 - 25
Number of leaves per 1 plant, pcs.	2 - 3	3 - 4	5 - 6	4 - 8	5 - 12
Length of leaves, cm	14 - 16	15 - 25	18 - 35	20 - 35	20 - 40

Continued

Width of leaves, cm	3 - 4	4 - 6	5 - 7	4 - 8	6 - 9
Number of flowers per 1 plant, pcs.	1	2 - 3	3 - 4	7 - 10	9 - 16
Perianth tube, cm	5 - 7	5 - 9	8 - 11	10 - 16	14 - 16
Petal length, cm	4 - 5	4 - 4.5	5 - 5.5	5 - 6	5 - 5.3
Petal width, cm	1.5 - 2	1.3 - 1.7	1 - 1.5	1 - 1.5	2 - 2.5
Number of boxes per 1 rast., pcs.	1	1	1	1 - 2	1 - 2
Box length, cm	2.5	3 - 3.5	2.5 - 3	2 - 3.5	3 - 3.5
Box width, cm	1.5	2 - 2.5	2 - 2.5	2 - 2.5	2.5 - 3
Number of seeds per 1 box, pcs.	9 - 15	12 - 16	10 - 14	15 - 20	15 - 18
The size of the tubers, cm	4 × 3.5	4 × 4	5 × 4	4.5-5.5	7 × 6

As can be seen from Table 1, depending on the age and climatic conditions, the size and quantity of the studied species increase. In 2025, 8-year-old plants growing in experimental garden plots reached a height of 18 - 25 cm, the number of leaves per plant is 5 - 12 pieces, the perianth tube is 14 - 16 cm, the petals are 5 - 5.3 cm long, the width is 2 - 2.5 cm, the number of boxes per plant is 1 - 2 pieces, the length of the box is 3 - 3.5 cm, width—2.5 - 3 cm, the number of seeds in one box is 15 - 18 pieces, the size of the tubers is 7 × 6 cm. The flowers appear in late August and early September. The perianth is funnel-shaped and bell-shaped with a long cylindrical tube, the leaves are blunt, and the flowers are purple-pink, sometimes dark purple. The following year, in spring, at the end of February, large lanceolate leaves appear from the bulb. In April, a green box appeared 2 - 4 cm long, 1.5 - 2 cm wide, then in the middle and end of May the boxes begin to darken, the ripe fruits turn brown, and over time the boxes dry out and crack. The corms are at rest throughout the summer. In August, the plants begin to bloom anew (Figure 4). However, the leaves do not appear.

Figure 4. Corm of 8-year-old *Colchicum autumnale* at the end of September 2025.

At the end of September, *Colchicum autumnale* flowers were falling, but some bushes continued to bloom.

It should be noted that in the conditions of the introduction of the city of Tashkent, it was noted that 8-year-old plants formed up to 18 corms on one bush (**Figure 5**), of which 12 - 16 flowers appeared. As soon as the bulbs were planted in August 2017, the plant bloomed immediately after 7 - 10 days, and in 2019-2020 it bore fruit. Flowering and fruiting continued until 2025. The senile period has not yet been marked.

Figure 5. Corms of 8-year-old *Colchicum autumnale* on one bush (2025).

4. Conclusions

Thus, as a result of studying *Colchicum autumnale* under the conditions of introduction in the Botanical Garden of the National University of Uzbekistan, fruits and seeds were formed annually, which represents a success of the introduction. The optimal and favorable conditions for this species in the introduction environment of the university's botanical garden were as follows: fertile, loose, and moderately moist soil; moderate watering; the presence of various pollinators, mainly bees; sufficient lighting (partial shade or light sun), etc.

It should be noted that in many areas of the city of Tashkent, the plant does not produce fruits [29]. The reason for this is unfavorable conditions, a lack of pollinators, depleted soil, excessive shading, or, conversely, overly dry and open sites. In addition, young or severely weakened tubers do not produce viable seeds.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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