Several features of growing *Colchicum autumnale* l. in the urban environment of Tashkent-Uzbekistan

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Abstract. For the first time, the collection of autumn colchicum was created at the experimental field site of the Tashkent State Agrarian University. In this paper, the issues of growing conditions for the growth and development of *Colchicum autumnale* l plant were deeply studied and investigated. It was revealed that the *Colchicum autumnale* l growth and development largely depend on the size of the corm and the type of soil conditions.

1. Introduction

*Colchicum autumnale* L. is a valuable medicinal plant. In the pharmaceutical industry, this plant is used as a medicinal raw material for the production of colhamin, which is part of the ointment for the treatment of forms of skin cancer of the first and second degree. Plant preparations in the form of tablets and in combination with other drugs are used for esophageal cancer, as well as for certain leukemias [1, 2].

*Colchicum* has long been used as a medicinal plant. Information about this is found in written sources of Ancient Egypt, India, Greece. *Colchicum* species were included in the first British Pharmacopoeia and are used to this day as an official medicine. At present, preparations from crocus crops are included in the pharmacopoeias of almost all countries of the world, as well as in the International Pharmacopoeia, published by the United Nations [2, 3, 4].

The genus *Colchicum* (Colchicaceae L.) belongs to the family *Colchicum* (Colchicaceae DC.) And has more than 60 species. Under natural conditions, representatives of this genus grow on the plains and in the mountains of Western Europe, the Mediterranean countries, Turkey, the Crimea, the Caucasus. The Russian name “crocus” reflects the peculiarities of the life cycle of these plants. These are corm ephemeral plants with aerial organs dying off for the summer and blooming mainly in the fall in a leafless state. There are many garden forms and varieties of aspen colchicum, which, as a rule, are more resistant in culture than the original species [4, 5].

Freshly dug colchicum tubers are used for medicinal raw materials, which are harvested in the fall, during the period of mass flowering of plants. *Colchicum autumnale* L. is of particular interest for the pharmaceutical industry, the corms of which contain the alkaloid colchamine, which is used for cancer [1, 5, 6].

Long-term introductory studies carried out by the Tashkent Botanical Garden of the Academy of Sciences of the Republic of Uzbekistan have proved the possibility of its successful cultivation in the conditions of Tashkent. The aim of the study was to create a collection of colchicum grown in the experimental field plot of the Tashkent State Agrarian University and the development of primary agricultural cultivation techniques for further expansion of their plantation.
2. Materials and Methods

The tasks of the research were to create collections of colchicum grown on the experimental field plot of the Tashkent State Agrarian University, to study the influence of growing conditions on the development of plants and to identify the primary agricultural cultivation technique.

At the same time, they paid attention to the following questions:

• to determine the optimal timing of planting of autumn colchicum;
• study of the influence of organic food on the growth and development of plants;
• identification of growing conditions for the growth and development of autumn crocus.

The objects of research were colchicum autumnale L., obtained from the Botanical Garden of the Academy of Sciences of the Republic of Uzbekistan. They differed in the size of the corms. The average mass of one corm was from 40.0 to 62.0 g. For the study, only selected (I analysis) corms were used.

In the conditions of Tashkent, autumn colchicum has two cycles (generative - in autumn and vegetative - in spring) of development. In the conditions of the Tashkent oasis, the beginning of the growing season of plants began after the snow melted for 3-5 days at a minimum positive air temperature (3-5 °C). This, as a rule, is the 1st-2nd decade of March. In April, the leaves reach full development - about 23-30 cm long, and 12-15 cm wide. From one corm, 4-5 bright green, broadly elliptic leaves with a wavy edge develop. In late June - early July, they die off. Colchicum blooms in autumn from mid-September for 30-40 days in a leafless state. Leaves develop in spring. Flowers bell-funnel-shaped, large, up to 8-10 cm in diameter. The fruits are laid underground. Seeds in a three-nested box are carried by the shoot to the surface next spring. After the seeds ripen (June), the aerial part dies off, and the corm falls into a state of summer dormancy.

In August 2017-2018, experiments were laid in the experimental field plot of the Tashkent State Agrarian University in 2 (on ordinary soils and with humus movements) options. In 2017, the crocus plant was planted on ordinary soils, and in 2018 the experiments were laid with the use of humus for planting onions. Experimental plots for planting bulbs were selected in accordance with the necessary agrotechnical requirements for growing crops. The soil conditions were even and well lit, with a light, nutritious neutral soil (pH 6). Plowing and soil preparation was carried out 1 month before planting. The row spacing when planting in both variants is 70 cm.

In our experiments, we used the usual (in the furrows - manually) method of planting the autumn crocus bulbs. The corms were planted taking into account the bio-ecological characteristics of the plants at a distance of 8-10 cm from each other, and the planting depth was 10-12 cm. Such a depth of planting of corms is considered optimal for cultivation. This is evidenced by many years of introduction research, as well as literary sources [7, 8, 9]. Ordinary planting will allow us to take care of the plants in a timely and harmless manner throughout the growing season.

Due to the limited amount of planting material in our experiments, 25 pcs identical bulbs with a diameter of 3.0-3.1 cm were planted. To study the effect of organic fertilizers on the growth and development of plants, as well as the output of corms, corms were planted with and without the introduction of organic fertilizers. Biometric measurements were performed on 10 model plants.

3. Results

Every year, by the end of the spring growing season, there is a change of corms and the formation of daughter (2-3) and children. The autumn crocus corms are oval in shape and reach a length of 6-10 cm. Outside, they are covered with dry dark brown shiny scales (n = 25). Table 1 shows the scheme of planting and output of bulbs of autumn colchicum.

The mass of one corm ranges from 40 to 65 g, which is indicated in literary sources. In the conditions of the Tashkent oasis, they are resistant to diseases and pests. All plant organs are poisonous - contain alkaloids.

Currently, the collection of Tashkent State Agrarian University contains about 500 specimens (about 50 bulbs obtained from the Botanical Garden of the Academy of Sciences of Uzbekistan, as well as those multiplied by us during the study) of plants.
Table 1. Planting of corms of autumn colchicum (n = 10)

| Plant model | Bulb diameter | Output of the bulb, pcs | Bulb diameter | Output of the bulb, pcs |
|-------------|---------------|-------------------------|---------------|-------------------------|
|             | Before planting (cm) | Before planting (cm) |               |                         |
| 1           | 2.79 ±1.25     | 2.89 ±1.15              | 3             |
| 2           | 2.63 ±1.05     | 2.93 ±1.09              | 2             |
| 3           | 2.59 ±1.01     | 3.05 ±1.23              | 4             |
| 4           | 2.71 ±1.21     | 2.96 ±1.32              | 4             |
| 5           | 2.70 ±1.22     | 2.82 ±1.03              | 4             |
| 6           | 3.00 ±1.17     | 2.93 ±1.0               | 3             |
| 7           | 2.62 ±1.08     | 3.06 ±1.35              | 2             |
| 8           | 2.65 ±1.25     | 3.10 ±1.02              | 4             |
| 9           | 2.82 ±1.17     | 2.97 ±1.3               | 4             |
| 10          | 2.78 ±1.16     | 2.89 ±1.06              | 4             |

When studying the seasonal rhythm of plant development, we did not trace a clearly pronounced relationship in the deviation from the norm of the passage of the phenophase of development. However, depending on soil conditions in plants growing under more favorable conditions (with the introduction of organic fertilizers), flowering lasted up to 25-35 days (Table 2).

And so, the planted corms grew almost 100%. The timing of autumn flowering in plants in the year of planting (2017) was observed in the first and second decade of September with a deviation of 2-5 days. Spring regrowth for the next year (2018) took place with an offset of 2-5 days, depending on the method of planting. In corms planted under more favorable conditions, the duration of flowering lasted up to 35 days. In subsequent years, regrowth of all experimental plants took place at their usual time (at the beginning of September). However, plants growing on normal soils showed weaker flowering. The flowers were comparatively smaller in size and the flowering time was 5-10 days shorter. This is explained by the fact that in plants growing under more favorable conditions due to the preservation of soil moisture, the growth and development of plants, as well as the duration of flowering, increases by 10-15 days. At the maximum growth and development of plants (in mid-May), biometric (measurements in the length and width of the leaf blade) counts were made (Table 3). The data obtained shows that soil conditions affect the dimensions of the aboveground parts of plants, such as the length of the leaf and the width of the leaf blade. The sizes of the aboveground and underground parts of plants decrease depending on the growing conditions, that is, plants growing on ordinary soil have a relatively lower aboveground phytomass and at the end of the growing season they form smaller corms.

Experiments have shown that the use of organic fertilizers has a positive effect on plant development. Plants grown on richer and more favorable soil conditions had a larger leaf blade. Thus, the width of the leaf blade was, on average, 1 cm larger, and the length by 1-3 cm. From the data obtained, it follows that the use of organic fertilizer has a positive effect on the development of the aboveground part of plants. The effect of organic fertilization on the productivity of colchicum corms was studied. For this purpose, after three years of planting in one place, the experimental plantings of autumn crocus were excavated according to the planting scheme indicated in Table 1, i.e. 25 corms each, planted with and without the use of organic fertilizers and the data obtained are shown in Table 4 (n = 10).

Experiments have shown that, regardless of the soil growing conditions, corms were laid on the plants. The use of organic fertilizers in the soil provides an increase in the biomass of corms, that the average mass of these bulbs in the experimental variants varies in the aisles from 10-15 g.
Table 2. Phenophases of the Colchicum aspen in the conditions of Tashkent

| Soil conditions                      | Variants | Flowering in 2017 | Passage of the phenophase in 2018 | Blooming |
|--------------------------------------|----------|-------------------|-----------------------------------|----------|
|                                      |          | Starting | Ending | Duration | Springs. Regrowth | Full unfolding of leaves | End of vegetation | Starting | Ending | Duration |
| Typical soil                         | 1        | 05.09    | 26.09  | 20       | 14.03             | 25.04              | 24.06             | 06.09    | 28.09  | 22       |
|                                      | 2        | 17.09    | 27.09  | 10       | 17.03             | 27.04              | 15.07             | 06.09    | 27.09  | 21       |
|                                      | 3        | 12.09    | 02.10  | 21       | 10.03             | 19.04              | 17.07             | 07.09    | 25.09  | 19       |
| With the introduction of organic fertilizers | 1        | 04.09    | 04.10  | 30       | 16.03             | 16.04              | 16.07             | 04.09    | 09.10  | 35       |
|                                      | 2        | 12.09    | 08.10  | 27       | 18.03             | 17.04              | 17.07             | 06.09    | 12.10  | 36       |
|                                      | 3        | 05.09    | 30.09  | 25       | 17.03             | 18.04              | 18.07             | 12.09    | 07.10  | 25       |

Table 3. Influence of soil conditions on plant growth and development

| Model plant | Leaf blade width, cm | Leaf blade length, cm | Plant height, cm |
|-------------|----------------------|-----------------------|-----------------|
|             | Typical soil         | With the introduction of organic fertilizers | Typical soil | With the introduction of organic fertilizers | Typical soil | With the introduction of organic fertilizers |
| 1           | 6.3                  | 7.5                   | 23.1            | 25.2              | 27.1          | 29.7              |
| 2           | 6.0                  | 6.7                   | 22.3            | 28.1              | 30.8          | 35.6              |
| 3           | 5.8                  | 7.2                   | 26.1            | 24.2              | 28.3          | 33.7              |
| 4           | 6.9                  | 6.5                   | 25.1            | 25.8              | 31.2          | 30.7              |
| 5           | 6.4                  | 8.1                   | 20.1            | 24.3              | 31.6          | 33.5              |
| 6           | 6.2                  | 6.6                   | 22.2            | 24.4              | 27.0          | 32.0              |
| 7           | 6.6                  | 7.9                   | 25.9            | 25.0              | 35.6          | 39.0              |
| 8           | 6.1                  | 7.4                   | 25.3            | 27.8              | 32.1          | 33.0              |
| 9           | 6.2                  | 6.8                   | 25.0            | 25.6              | 28.5          | 30.3              |
| 10          | 5.6                  | 6.7                   | 24.3            | 26.0              | 33.7          | 35.7              |
| Average     | 6.7±0.5              | 7.6±1.4               | 23.9±0.8        | 25.8±2.2          | 30.6±0.5      | 33.8±1.9          |
Table 4. Influence of soil conditions on the productivity of corms of autumn colchicum

| Model Plants | Output of corms |  | With the introduction of organic fertilizers |
|--------------|----------------|---|------------------------------------------|
|              | Weight, grams  |   | Weight, grams                            |
|              | One corm       | Total | One corm       | Total |
| 1            | 42.8 ±1.25     | 42.8 | 44.3±1.05     | 133.0 |
| 2            | 35.4 ±1.05     | 71.0 | 57.6±1.21     | 114.5 |
| 3            | 42.2 ±1.01     | 42.3 | 57.4±0.89     | 230.0 |
| 4            | 39.7 ±1.21     | 79.5 | 44.2±1.14     | 177.0 |
| 5            | 32.2 ±1.22     | 64.5 | 44.7±1.20     | 179.0 |
| 6            | 38.9 ±1.17     | 38.9 | 39.9±1.22     | 120.0 |
| 7            | 35.3 ±1.08     | 70.7 | 57.5±1.21     | 115.0 |
| 8            | 44.1 ±1.25     | 44.1 | 39.1±1.14     | 156.0 |
| 9            | 50.5±1.17      | 50.5 | 45.7±1.11     | 183.0 |
| 10           | 75.8±1.16      | 75.8 | 51.2±1.18     | 205.0 |

Thus, the use of organic fertilizers has a positive effect on plant development. In plants growing under more favorable conditions due to the preservation of soil moisture, the growth and development of plants, as well as the duration of flowering, increase by 10-15 days. Plants grown in richer and more favorable soil conditions had a larger leaf blade. Adding organic fertilizers to soils provides an increase in the biomass of corms by 2 times more.

In the future, it is planned to study the duration of cultivation of autumn colchicum, in order to identify the optimal period of its cultivation. Preliminary excavations were carried out in the 1st and 2nd year of cultivation. The dug out corms were collected and stored in boxes with a layer of no more than 10-1 cm and dried for 10-15 days in well-ventilated storage facilities. Then the outer covering scales were cleaned, sick and damaged corms were culled. The corms intended for planting, after cleaning, were stored in a dry and cool room. Since all organs of colchicum are poisonous, work related to plants should be carried out with rubber gloves. According to our preliminary data, in the conditions of the Tashkent oasis, the duration of growing colchicum in autumn is 2 - 3 years of cultivation.

4. Discussion

Discussing the obtained results of cultivation of colchicum in autumn, it is necessary to take into account the following:

- Selected site for planting should be flat, in order to avoid stagnation of melt and other waters, which can lead to soaking and death of corms. The selected area should be well lit, since colchicum is a photophilous plant. Planting colchicum should be carried out at the end of August, which improves the normal vegetation of plants, including the formation of corms.

- Soil conditions should preferably be sandy or loamy and well lit, with light, nutritious soil with a neutral reaction (pH 6). Soils should be sufficiently permeable and moisture-consuming, rich in humus. Purely sandy soils are of little use for growing colchicum, as they dry out quickly and suffer from uneven moisture during the growing season. To increase soil fertility, rotted manure is introduced.

- It is better to prepare the soil for planting colchicum in the fall, using deep plowing or digging. 20-30 days before planting, the soil is plowed to a depth of 25-30 cm with the introduction of organic fertilizers. From organic matter, it can be humus or well-rotted compost in an amount of 10-15 kg/m². The use of fresh manure directly for planting bulbous plants, including colchicum, is unacceptable, since they contribute to the development and spread of fungal diseases.

- Planting terms are associated with the biological characteristics of plants [10, 11, 12]. Corms should be planted at the end of August (20-31), when cooler weather sets in, which is favorable for the rooting of corms. Rooting lasts 15-20 days, then corms bloom. Planting at a later date is undesirable, since in this case the plants take root worse, and it is much more difficult for them to endure unfavorable weather conditions in winter.
- With an ordinary planting, corms are planted at a distance of 60-70 cm between rows and 8-10 between individual plants. With such a planting, 100-150 thousand plants are placed on a hectare. Ordinary planting allows you to mechanize all care processes.

- When planting, the depth of planting of corms in the soil is of particular importance. It depends on the size of the corm and the type of soil. Corms of colchicum on loamy soils are planted to a depth of 10-15 cm. On light sandy loamy and sandy soils, the planting depth increases from 16 to 20 cm. Smaller corms (Parsing and baby) are planted to a depth of 5-8 cm. 20 cm is undesirable, as this leads to a decrease in breeding productivity, the corms become smaller, and their harvesting becomes more difficult.

- The necessary complex of agrotechnical measures for the care of plants includes hoeing, loosening and removing weeds. The colchicum does not need watering, however, watering (in the month of May) affects the duration of the growing season.

- The plants are dug out after the foliage has died. In the conditions of Tashkent, this is mid-July. Plants are practically not affected by diseases and pests.

5. Conclusions
   1. Colchicum aspen is promising for cultivation in the conditions of the Tashkent oasis.
   2. The selected area should be well lit, since colchicum is a light-loving plant. Soils should be sufficiently permeable and moisture-consuming, rich in humus. To increase soil fertility, rotted manure is introduced.
   3. The optimal time for planting bulbs is August. Corms are planted at a distance of 60-70 cm between rows and 8-10 between individual plants. With such a planting, 100-150 thousand plants are placed on a hectare.
   4. Corms of colchicum on loamy soils are planted to a depth of 10-15 cm. On light sandy loam and sandy soils, the planting depth increases from 16 to 20 cm smaller corms (Parsing and baby) are planted to a depth of 5-8 cm.
   5. The use of organic fertilizers has a positive effect on plant development. Plants growing under more favorable conditions due to the preservation of soil moisture, the growth and development of plants, as well as the duration of flowering increase by 10-15 days. Plants grown on richer and more favorable soil conditions had a larger leaf blade. The addition of organic fertilizers to the soil provides an increase in the biomass of corms by 2 times more.
   6. Agrotechnical measures for the care of plants include hoeing, loosening and removing weeds. Colchicum does not need watering. When watering in May, the growing season lasts 5-7 days.

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