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Anti-Ecology of the "Lavon" Lily Variety in Different Growing Conditions of the Samarkand Region, Uzbekistan

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Abstract

Lilies are widely recognized as beautiful and ornamental flowers, renowned throughout the world. They are the most popular perennial plants used in landscape design, commonly found in gardens and boulevards, but in recent years, they have also become increasingly popular as houseplants. Lilies have been known in culture for thousands of years and cultivated as food, medicinal and ornamental plants, decorating palaces and temples. Today, these garden flowers occupy one of the leading places in landscaping due to the variety of forms, aroma and rich flower coloring. The color palette of lilies includes almost all colors and shades, with the exception of blue tones. Lilies are distinguished by a long, plentiful flowering, and you can admire them almost all summer, if you choose the right species and varieties [1]. The British Royal Horticultural Society, in conjunction with state commissions, is actively engaged in testing new varieties of lilies in many countries, with the aim of creating new varieties for international registration. One such cultivar is the "Lavon" lily, which is characterized by early flowering and entomophilous traits. As the timing of flower opening during the day is closely related to the summer dynamics of insect pollinator activity, the "Lavon" lily has the potential to be an important addition to the world of horticulture. For the first time in the conditions of closed and open ground in the city of Samarkand, the morphological features of the flowers of the lily variety "Lavon" and the biology of flowering were studied. The phenology of this variety was revealed and its phenospectrum was compiled.

Keywords

Introduction, Variety, Vegetation, Flowering, Fruiting, Pollination, Phenospectrum

1. Introduction

Ornamental landscape plants are cultivated for the purpose of landscaping and beautifying cities and villages, parks, social and industrial buildings, and residential structures, as well as for creating bouquets. They are typically distinguished by their attractive leaves, flowers, fruits, coloring, and unique shapes, such as hanging branches, umbrella-shaped canopies, and columnar structures.

Lilies are highly ornamental perennial plants with a long history of cultivation. Their wide range of species, varieties, and hybrid forms make them a popular choice for decorating a variety of settings, including gardens, parks, industrial facilities, cultural institutions, educational campuses, and private residences, throughout the spring and autumn seasons. Lilies are characterized by their beautiful, diverse flowers, which exhibit a wide range of shapes and colors. Many species and varieties are suitable for greenhouse forcing [2] and are also used as cut flowers in open ground. Lilies have also been used in folk medicine as a remedy [3]. Additionally, in East Asia, lilies are cultivated as a vegetable crop for their edible bulbs [4].

Lilies are perennial bulbous plants, in which the bulb is a strongly shortened perennial shoot of stolon or rhizome type, consisting of succulent open scales without specialized integumentary scales. Roots extending from the bottom of the bulb are perennial, and in some species, annual roots develop on the underground part of the stem. Bulbs lack protective covers and can vary in size from 1.5 to 10 cm in different species [1]. Currently, there are approximately 100 species and over 5000 varieties of lilies, although some sources report over 10,000 varieties [5].

Over the past 50 years, interest in lily culture has grown worldwide, due to using them to get colors on cut in closed ground. Currently leading positions in the creation of new varieties are occupied by the Netherlands [Lim, 2006]. Crosses and selection spend indoors, so they are badly adapted to open ground conditions, are short-lived and die quickly.

In recent years, the phytochemical and antioxidant properties of the Water Lilies family have been studied in the conditions of the Senegal River Valley [6], comparative assessment of Lilies varieties by production coefficient *in vitro* culture [7], comparative assessments of different varieties of Asian hybrids in Altai [8], and the influence on the growth and development of temperature of Lily varieties [9].

2. Research Methods

Currently, lilies are generally classified into varietal (hybrid) and species (wild) types. Typically, it is more challenging to cultivate species lilies under garden conditions, especially for novice gardeners. These plants are better suited for cultivation in greenhouses, winter gardens, and botanical gardens. However, species lilies are used in medicinal applications and have spread or turban-shaped inflorescences, with petals that can exhibit a wide range of shades. While more than a

hundred subspecies are classified as wild varieties, only 16 of them can be grown in Russia and the CIS countries. These varieties are well-suited to the climatic conditions of the middle zone, as they can withstand sharp temperature fluctuations and are resistant to moisture.

There are various classifications for lilies, including those for wild species (Comber's classification, 1949) and hybrid forms (de Graaf's classification, 1964). However, the most widely used classification is the International Classification, which was developed in 1982 and includes both species and hybrid forms.

According to the International Classification, which was developed by Jan de Graaf in the United States, hybrid lilies are divided into 9 sections based on their origin and common biological characteristics.

The Lavon variety, for example, is an OT hybrid resulting from a cross between Oriental hybrids and Trumpets in 1980. Hybrid lilies are known for their remarkable range of colors, which can range from pure and expressive to contrasting combinations of bright tropical shades.

More recently, terry varieties of lilies have emerged, and OT hybrids are becoming popular choices for landscape compositions. For instance, the Lavon variety (also known as TOUCHING) features creamy yellow flowers with a pronounced crimson center in the form of a star, with rays extending 2/3 of the length of the petal. The flowers have no dots but have papillomas, with yellow-green nectaries, dark brown anthers, and a grey snout. The edges of the petals are slightly wavy, while the tips are strongly curved. The flowers are large, measuring 18 cm in diameter and directed to the sides, while the plant can reach a height of 90 - 110 cm (and up to 1.5 m or more with age), with the number of flowers increasing to 15 - 20 pieces.

The decorative qualities of lilies include such indicators as shape, flower size, color and number of flowers in one peduncle. According to M.V. Baranova [1] varieties of lilies have different shapes flowers: cupped, star-shaped, wide-cupped, chalmoid, funnel-shaped, and tubular.

The present research was conducted at Samarkand State University's greenhouse and experimental plots between 2021 and 2023.

To classify the generative organs morphologically, we employed the method developed by I.G. Serebyakova [10], while the biology of flowering was investigated using the methods described by A.A. Kazakov [11] and A.N. Ponomarev [12]. The experimental data were analyzed using the Microsoft Excel-2003 program and the statistical method of Zaitsev [13].

3. Results and Discussion

Investigating the vegetative and generative organs of the "Lavon" lily variety is essential for its successful introduction into the Samarkand region. The leaves of this variety are arranged in alternating segments along the stem and are elongated, with a leaf strip attaching them to the stem. The stem is above-ground, slightly bent from the ground, and has a green tubular shape, with a height

ranging from 30 - 250 cm. In the first year, the plant's height reaches 60 - 80 cm, while in the second year, it can reach up to 250 cm. The stem surface is smooth, and small bulbs appear in the lower segments of the stem, which will propagate next year. While this feature is more common in cultivars, it may be rare in the wild [1].

The leaves of the lily plant have parallel veins and are arranged in a single row along the stem. Each leaf is 8 cm long and 2.5 cm wide. High air temperatures can accelerate leaf opening, but this can negatively impact the quality of the leaf. The optimal temperature range for lily plant growth is 16˚C - 25˚C. Temperatures higher than 28˚C can cause the plant to grow shorter, have fewer flower buds, and cause leaf yellowing and dehydration [6]. Leaf counting begins 3 - 4 weeks after the appearance of the flower buds. Leaves with tips turned outward at an angle of 45˚ from the stem are considered in the count. For example, if the sampling date is April 20, and there are 32 open leaves, this means that one leaf has opened per day. After 40 days, when the temperature rises to 22˚C - 27˚C, the rate of leaf opening reaches 1.5.

32 sheets/30 days = 1.06 sheets per day/18˚C - 22˚C

58 leaves/40 days = 1.46 leaves per day/23˚C - 27˚C

An increase in air temperature leads to a higher number of leaves opening during the day. The growth and development of lily plants can differ depending on whether they are planted in open or closed areas (see **Table 1**). Plants planted in closed areas tend to lag behind in development compared to those in open areas. As shown in the table, the height of plants planted in open ground was 80 - 82 cm.

The morphological structure of the clusters of "Lavon" lilies is characterized by a diameter of 20 - 25 cm and a width of 11 - 12 cm. The clusters consist of monochromatic flowers, which are organized in a homochlamyd form instead of a cup-shaped flower (**Figure 1**).

Table 1. Biomorphological indicators in different growing conditions (n = 10).

Biomorphological indicators, cm	Open ground (06.03.2022)	Closed ground (06.03.2022)
Stem length	80 ± 5.5	65 ± 4.5
Stem width	1.5 ± 0.05	1.2 ± 0.06
Leaf width on the stem	2.5 ± 0.09	2.1 ± 0.08
Stem diameter	16 ± 2.5	14 ± 2.4
Bulb growth	4.4 ± 0.8	4.2 ± 0.6
Bulb width	2.5 ± 0.5	2.1 ± 0.08
Bulb root length	25 ± 5	20 ± 5
Bud length	12 ± 1.2	11.5 ± 0.5
Fruit growth	3.6 ± 0.5	3.4 ± 0.5
Fruit width	1.5 ± 0.08	1.2 ± 0.05

Note: $P < 0.01$.

Figure 1. General view of the Lily variety Lavon and the processes of studying its biology of flowering.

The "Lavon" lily variety exhibits no fundamental differences in the morphological form of its flowers, their size, degree of openness, or area sizes. Each flower is surrounded by 6 leaves that result from two shoots, with each ring of the circle consisting of 3 leaves. The lower part and sides of the folded leaves are slightly thinner, and the shape is slightly bent along the outer edge. The flowers are arranged singly on the stem. The leaves in front of the flower vary in size and have red spots, which start from the base and reach the middle part. The inner part of the leaves is red, the outer is pale yellow, and the edges are white. The flowers have 6 stamens and 1 seed, are very fragrant with a pungent smell, and bloom for 7 - 10 days.

The flower parts of the "Lavon" lily variety have the following dimensions: length 11 ± 0.8 cm (excluding petals), length 1.5 ± 0.05 cm, and width 0.8 ± 0.04 cm. The six stamens are equal to each other, and the pollen grains are correctly formed and mixed.

The blade is cylindrical, thin, and smooth, with a length of 7.5 ± 0.8 cm. The seed is 9.2 ± 0.5 cm long, with a spherical shape of 2.0 ± 0.08 cm, and an erect cylindrical stem that is divided into four parts. A comparative analysis of the "Lavon" lily grown in two experimental plots is presented in **Table 2**.

Table 2. Indicators of flower parts in different growing conditions (n = 10).

Signs of parts of a flower, cm	Open ground	Indoor ground
Length of leaves crowing a flower	11 ± 0.8	10 ± 0.6
Flower teeth length	1.5 ± 0.05	1.3 ± 0.04
Width of flower teeth	0.8 ± 0.04	0.7 ± 0.035
Length of pollinating threads	7.5 ± 0.8	7.2 ± 0.8
Stamen length	2.0 ± 0.04	1.8 ± 0.02
Stamen width	0.2 ± 0.01	0.2 ± 0.01
Total length of the testis	9.2 ± 0.5	9.1 ± 0.5
Knot length	2.0 ± 0.08	2.0 ± 0.08
Knot width	1.6 ± 0.06	1.3 ± 0.05
Surface length	6.3 ± 0.2	6.1 ± 0.1
Front part diameter	0.6 ± 0.05	0.5 ± 0.03
Front part length	0.56 ±0.01	0.50 ± 0.01

Note: $P < 0.01$.

Phenological observations indicate that the "Lavon" lily variety belongs to the early flowering group, with a maximum daily growth of 0.8 cm to 1 cm during the growth phase. Among the tested varieties, this variety stands out for its bio-morphological features, including an abundance of inflorescences, multi-seeded pods, high pollinator fertility, high fruit formation, and high seed yield. Rapid growth of the plant (1.0 - 1.5 cm) is observed during the growth and budding phase. The duration of lily flowering varies from year to year, with an unchanged sequence. The vegetation phase begins on April 20 and lasts for 35 days. The budding phase starts on May 20 and ends on June 8. The flowering period begins on June 10 and lasts until August 20. The seed formation period starts on July 1 and ends on August 20 (**Figure 2**).

The "Lovan" lily variety is considered to be an entomophile due to the timing of its flower opening, which is closely related to the summer activity of pollinating insects. Temperature and light are the primary regulating factors in this process. The flowers are typical of plants that open during the day, with the opening usually beginning at 6:00 in the morning. Rapid flower opening occurs between 8:00 and 10:00 in the morning at an air temperature of +22˚C to +28˚C, when all physiological processes are in harmony.

The timing of flower opening is an important feature of plant adaptation, which involves the full implementation of certain physiological processes at specific times of the day or in response to specific needs.

The opening of flowers is a unique and characteristic feature of various plants, and occurs in a specific pattern of harmony at certain times of the day (**Figure 3**).

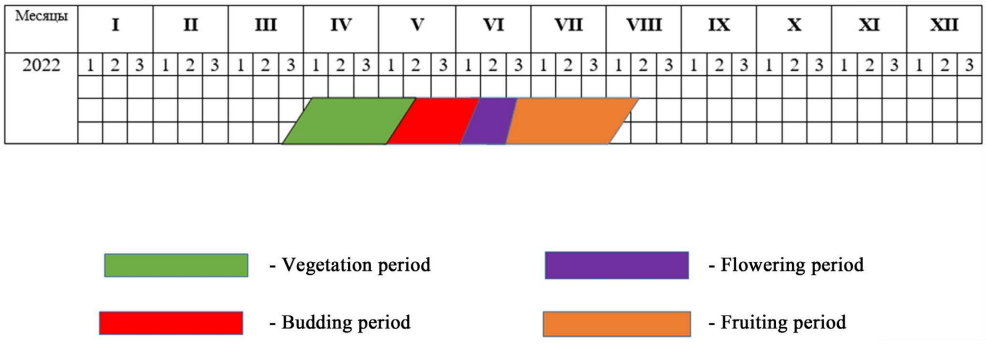

Figure 2. Phenological spectrum of lily variety "Lovan".

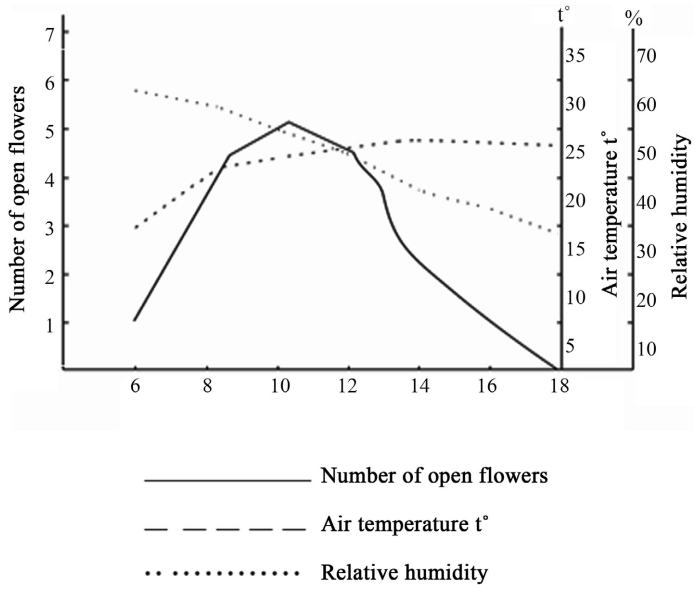

Figure 3. The rhythm of flower opening during the general flowering period of the "Lovan" lily variety.

4. Conclusion

In conclusion, the flowers of the "Lovan" lily variety open during the day, with each flower taking 8 - 9 days to fully open. The flowering period begins at 6:00 in the morning and lasts until 18:00. Growth regulators are essential for promoting good growth and high-quality flowers. To determine the effect of growth regulators, the following substances are used at concentrations recommended by the manufacturer: 0.001% krezatsin, 0.01% root powder, 0.02% maxim dachnik (ampoules), and vermiculite (mineral fertilizer) during planting.

Conflicts of Interest

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

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