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STAGES OF PHENOLOGICAL DEVELOPMENT OF SOME OF THE SPECIES OF *Magnolia L.* IN ABSHERON

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ЭТАПЫ ФЕНОЛОГИЧЕСКОГО РАЗВИТИЯ НЕКОТОРЫХ ВИДОВ *Magnolia L.* НА АПШЕРОНЕ

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Abstract. The article analyzes the stages of phenological development of 3 species of the genus *Magnolia L.* In the research work, the biology of leafing, budding, flowering, fruit-bearing of some species belonging to the genus *Magnolia* in Absheron conditions was studied on a scientific basis. The vegetation period of the species we studied was studied and climatic factors that positively or negatively affected this period were studied. The studied species were divided into groups according to the onset of flowering and the duration of this period. Thus, the entry and duration of *Magnolia L.* species in the Absheron region depends on the meteorological and climatic factors of the region where they are introduced, especially the air temperature and relative humidity.

Аннотация. В статье проанализированы этапы фенологического развития 3-х видов рода *Magnolia L.* (Магнолия). В научно-исследовательской работе на научной основе изучена биология облиственности, бутонизации, цветения, плодоношения некоторых видов, относящихся к роду *Magnolia*, в условиях Апшерона. Изучены вегетационный период объектов исследования, а также климатические факторы, положительно или отрицательно влияющие на этот период. Исследуемые виды были разделены на группы по началу цветения и продолжительности этого периода. Таким образом, проникновение и продолжительность вселения видов *Magnolia L.* в Апшеронский район зависит от метеорологических и климатических факторов региона, в котором они интродуцированы, особенно от температуры и относительной влажности воздуха.

Keywords: magnolia, flowering, buds, fruiting, phenological development, vegetation period.

Ключевые слова: магнолия, цветение, бутоны, плодоношение, фенологическое развитие, вегетационный период.

Introduction

Trees and shrubs with decorative features are widely used in ornamental gardening in our republic. It should be noted that the correct choice of ornamental plants in single and group plantings in the planting of modern greenery is one of the important issues in parks and gardens. The aim of the research is to study the phenological developmental phases of some species of the newly introduced magnolia genus in the construction of parks and gardens of the Absheron Peninsula [1].

Materials and Methods

The experimental area of the Institute of Dendrology was chosen as the object of research. The annual growth and development of plants were studied by the methods of P. I. Lapin [3], A. A. Molchanov, V. V. Smirnov [5]. Measurements were taken on selected specimens every 10 days from the beginning to the end of the growing season to determine the growth dynamics of 1-3-year-old plants. Observations on the stages of seasonal development were carried out in accordance with the methods proposed by the General Botanical Garden of the Russian Academy of Sciences named after V. N. Sin [4] and I. N. Beidemann [2]. The onset, end, and duration of seasonal developmental stages (shoot swelling, leaf opening, budding, flowering, beginning and end of growth) were analyzed for older specimens. Daily observations on the opening and pollination of flowers were studied according to the methodology of A. N. Ponomarev [7].

In addition to personal research on the phenological stages of development of species belonging to the genus *Magnolia*, other literature was used.

Analysis and Discussion

Magnolia grandiflora L., *Magnolia kobus* DC., *Magnolia liliiflora* belonging to the genus *Magnolia* L. were analyzed for phenological stages of development in Absheron conditions — budding, beginning of flowering, mass flowering, and end of flowering.

One of the main indicators of the adaptation of *Magnolia* L. species to the conditions of new introduction is the successive stages of phenological development and, as a result, the assessment of the degree of adaptation to these conditions. Phenological developmental stages — the seasonal development of individual organs of plants leads to the development of the plant organism, reflecting the morphological stages and appearance [6].

In the course of the study, it was found that the beginning, end, and duration of the developmental stages of the season are characterized by many characteristics of the species: the geographical origin of the species, systematic status, age, etc. At the same time, as a result of climate change in the Absheron Peninsula, the plant was more affected by complex climatic factors. These factors affect the rhythm of the phenological stages of development of plants during the growing season; play an important role in the development of branches, differentiation of flower organs, in the dormant period. It should be noted that the study of the sequence of phenological developmental stages of the applied species is one of the key factors in the field of introduction and acclimatization. The research covers the years 2017-2021, and the following results were obtained in the analysis of the stages of phenological development (Table 1).

In the analysis of phenological developmental phases, it was found that the beginning of each developmental stage occurs under certain temperature conditions. The results of the study of seasonal growth rhythms in the dry subtropical climate of Absheron showed that the active period of activity of magnolias was observed at a temperature of 16-18C°. The sooner such temperature conditions are observed, the sooner the seasonal development stages begin. During this period, the flower organs begin to grow, and this stage coincides with the beginning of the budding phase. In winter, the flower organs do not change significantly. In the later stages of organogenesis, flowering, growth and maturation of fruits and seeds occur. Studies have shown that the formation and differentiation of buds at the stages of organogenesis of generative and vegetative buds of deciduous and evergreen species did not occur simultaneously: it was found that the process of differentiation is faster in short branches with early growth [8-10].

Table 1

STAGES OF PHENOLOGICAL DEVELOPMENT OF SOME
 OF THE SPECIES OF *Magnolia L.* IN ABSHERON (2017-2020)

Swelling of the leaf spine	Opening the leaf	Budding	Flowering			Fruit formation	Full ripening of the fruit	Leaf shedding		Vegetation period
			Getting started	Mass	Ending			Getting started	Ending	
<i>Magnolia grandiflora</i>										
25.03±5	10.04±3	01.05±4	15.05±3	15.06±5	10.07±4	20.08±4	10.10±5	08.11	03.12	215±5
<i>Magnolia liliiflora</i>										
28.04±4	10.05±4	05.03±5	15.04±5	05.05±4	20.05±5	30.05	-	28.10±4	07.11±4	240±5
<i>Magnolia kobus</i>										
10.04±6	15.04±4	20.02±2	25.03±4	05.04±5	20.04±4	25.05±3	30.09±3	10.10±6	25.10±5	245±5

In some species, because the generative organs do not go through a period of rest, the shoots are located at the ends of short branches, shoots formed on long branches are formed relatively quickly, grow in size and develop better [3].

Observations showed that swelling of new leaf shoots of the evergreen *Magnolia grandiflora* occurs in the third decade of March (25,03±5), and leaf opening occurs in the first decade of April (10,04±3). Budding is observed in early May — 01,05±4. The first flowers appear on the plant in mid-May (15,05±3) (Figure 1). The flowers appear on the branches of the current year. Mass flowering is observed in the second decade of June (15,06±5). During this period, large, porcelain-like, white, fragrant flowers up to 18-20 cm in diameter can be seen on the plant. Flowering in large magnolias lasts longer than in other species and ends on 10,07±4. Thus, the surface of the tree is covered with buds, at the same time a small number of flowers bloom, and as a result, flowering continues for a long time in a row. The life of each flower is 2-3, sometimes 7-10 days, depending on climatic conditions. In Absheron conditions, flowering of each large *Magnolia* lasts up to 55±4 days. Full ripening of the fruit is observed in early October (Figure 2).



Figure 1. Appearance of a flower of the genus *Magnolia grandiflora*



Figure 2. *Magnolia grandiflora* species at the stage of fruit ripening

In the fast-flowering *M. liliiflora* species, budding and flowering are observed before the opening of the leaf shoots (Figure 3). Thus, budding is observed in the first decade of March — $05,03 \pm 5$. The first flowers open in the second decade of April ($15,04 \pm 5$). Mass flowering is observed after 11-15 days, in the first decade of May ($05,05 \pm 4$). Before the leaves open, the plant is covered with raspberry-purple flowers on the outside in the form of a cup (lily) and white on the inside, 3-4 cm in diameter.

The duration of the flowers depends on the temperature and humidity. Thus, the life of a flower is 7-10 days when the temperature is high (24°C) and the relative humidity is low (60-70%), and when the temperature is relatively low ($20-22^{\circ}\text{C}$) and the relative humidity is high (85-100%) it will be 12-14 days. Flowering period lasts up to 35 ± 4 days. Flowering of lily magnolia ends in the second decade of May ($20,05 \pm 5$), depending on climatic conditions. In some cases, the plant blooms one by one for the second time in late summer. Swelling of the leaf shoots was observed in late April — $28,04 \pm 4$, and opening in the first decade of May ($10,05 \pm 4$). There was no fruiting stage of this species. Yellowing and shedding of leaves lasts from $28,10 \pm 4$ to $07,11 \pm 4$.

M. kobus is a fast-growing species compared to the large-flowered magnolia species. Buds are observed before the leaf shoots open ($20,02 \pm 2$). Swelling of flower buds is observed in late February and the first flowers open in the third decade of March ($25,03 \pm 4$) (Figure 4).



Figure 3. Buds and first flowering of *Magnolia liliiflora*

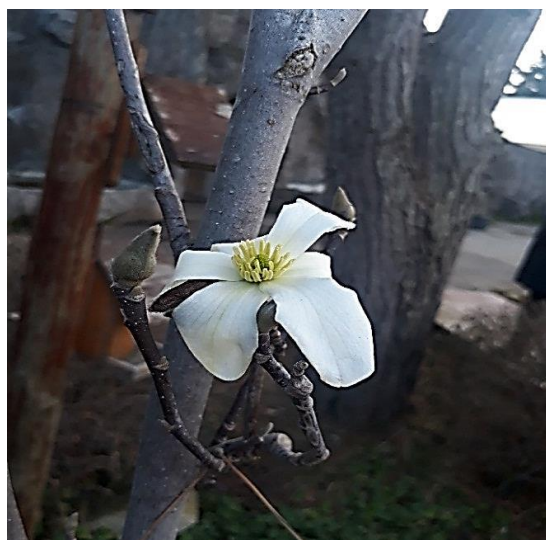


Figure 4. Flowering in species of *Magnolia kobus*

Mass flowering appears in the first decade of April ($05,04 \pm 5$). There is a time of 9-12 days between the first flowering and mass flowering. Flowering ends in late April ($20,04 \pm 4$). The flowering period lasts 25 ± 4 days. Swelling of the leaf shoots occurs on $10,04 \pm 6$ depending on climatic conditions. Already during this period, enough flowers are observed on the plant. The lifespan of a flower is 6-9 days. No second flowering was observed in the plant. The opening of the leaves is celebrated in the period after mass flowering — on $15,04 \pm 4$. The fruits begin to form in late May and fully ripen in late September. From the first decade of October, gradual yellowing and shedding of leaves is observed ($10,10 \pm 6 - 25,10 \pm 5$).

Thus, the entry and duration of *Magnolia* L. species in the Absheron region depends on the meteorological and climatic factors of the region where they are introduced, especially the air temperature and relative humidity.

The species we studied were divided into 3 groups according to the duration of flowering:

1. Early flowering species (flowering begins in the second and third decade of March): *M. kobus*;

2. Medium-flowering species *M. liliiflora* (flowering begins in the second decade of April)

3. Late flowering species (flowering begins in mid — May): *Magnolia grandiflora*.

The species we studied were divided into 3 groups according to the duration of flowering:

Group I: flowering ends soon — *M. kobus* (flowering begins and ends in 25 days).

Group II: lasts for a medium time — *Magnolia liliiflora* (beginning and end of flowering lasted 35 days).

Group III: flowering lasts a long time — *Magnolia grandiflora* (flowering lasts up to 55 days).

During our observations, the vegetation period for the studied species was also announced. It is known that the duration of phenological phases also depends on temperature. For the flowering period as a whole and for some of its phases individually (mass flowering period and end of the flowering period), the same period is observed with increasing temperature, and the minimum temperature plays a greater role than the average and maximum temperature. However, the budding stage is conditioned by the opposite of the flowering stage: when the minimum temperature is high enough and does not fall below a certain threshold, the budding time will be shorter.

When studying the duration of vegetation, it was found that temperature changes are characterized by faster onset and late end of vegetation. Based on our observations in Absheron, it became clear that early onset and late termination of vegetation, depending on climatic factors, lead to an increase in vegetation period, while late onset and early termination lead to a decrease in vegetation period. In the nightshade *Magnolia kobus* species, the vegetation period ends with the shedding of leaves and lasts up to 245±5 days. In *M. liliiflora*, the vegetation period lasts 240±5 days. In the evergreen *Magnolia grandiflora*, it lasted 215±5 days longer than in other species.

Age of first flowering

The inclusion of the introduced plants in the flowering phase was the main indicator of its adaptation to local conditions, along with the climatic characteristics of the conditions (temperature, humidity, precipitation and number of light days during the growing season). There is some information in the literature about the age of the first flowering of *Magnolia* L. Our research was mainly conducted on older copies. Among the species studied in Absheron conditions, *Magnolia kobus* entered the flowering stage at the age of 12, *M. grandiflora* at the age of 14, and *Magnolia liliiflora* at the age of 9 (Table 2).

Table 2

DURATION OF FLOWERING (2017-2020)

<i>Species</i>	<i>Age of entry into the flowering stage, days</i>	<i>Duration of flowering, days</i>	<i>The life of a flower, Day</i>	<i>Air temperature, °C</i>	<i>Relative humidity, %</i>
<i>Magnolia grandiflora</i>	14	55 ± 4	3-5	20.0-28.0	80-85
<i>Magnolia liliiflora</i>	9	35 ± 4	7-10	13.0-20.0	75-80
<i>Magnolia kobus</i>	12	25 ± 4	6-9	15.0-22.0	70-75

It is known from the literature that flowering II is very rare in the studied species (2). V. Z. Gusinashvili shows the flowering II as a remnant of seasonal development [3].

The duration of a flower was also studied during the observations (Table 2). The duration of a flower in the studied species depends on climatic conditions, lasts up to 10 days, and in sunny

weather the duration of a flower is reduced by half. Low temperatures and high relative humidity increase the life of the flower. The average lifespan of a flower is 5-10 days at an average temperature of 10-24° C and relative humidity of 60-70%. The maximum lifespan of a flower was 10 days when the average daily temperature was 8.5-22°C and the relative humidity was 85-90%. On sunny days, the life of the flower is shortened, and the minimum lifespan of a flower is 3-5 days. Information on the age and morphological characteristics of the studied *Magnolia* species is described in Table 3. Phenological development stages, age and morphological indicators of the studied species during 3 years (2017-2020) were analyzed and the results of the research are given in Table 3.

Table 3

AGE AND MORPHOLOGICAL CHARACTERISTICS
 OF SOME STUDIED SPECIES OF *Magnolia* L

<i>Species</i>	<i>Age, year</i>	<i>location area</i>	<i>Vital Form</i>	<i>Height, M</i>	<i>Body diameter, cm</i>	<i>Umbrella diameter, m</i>
<i>Magnolia grandiflora</i>	15	Baku	A	8.5	9	8.5 x 3.5
<i>Magnolia liliiflora</i>	10	D / Ī	K	6.5	5 (multiple stems)	1.5 x 2.0
<i>Magnolia kobus</i>	12	Baku	A	12.70	7	3.4 x 3.6

Conclusion

As a result of the research work, it was found out that *Magnolia grandiflora*, *M. liliiflora*, *M. kobus* species belonging to the genus *Magnolia* have adapted to the conditions of Absheron, entered the biology of budding, flowering, fruit-bearing, completely completes vegetation and is intended for use in decorative landscaping. In *M. liliiflora*, although fruit cones were formed, no seeds were obtained.

In the research work, the phenological development phases of *Magnolia grandiflora*, *M. liliiflora*, *M. kobus* species in Absheron conditions, vegetation period, and flowering and fruit-bearing biology were studied on a scientific basis. The studied species are divided into 3 groups according to the flowering period:

1. Rapid flowering species (flowering begins in the second and third decade of March): *M. kobus*;

2. Medium-flowering species *M. liliiflora* (flowering begins in the second decade of April)

3. Late flowering species (flowering begins in mid-May): *Magnolia grandiflora*.

Magnolia species are also divided into 3 groups according to the duration of flowering:

Group I: flowering ends soon — *M. kobus* (flowering begins and ends in 25 days).

Group II: lasts for a medium time — *Magnolia liliiflora* (beginning and end of flowering lasted 35 days).

Group III: flowering lasts a long time — *Magnolia grandiflora* (flowering lasts up to 55 days).

In addition, the age and morphological characteristics of the species were analyzed. Thus, in Absheron conditions, *Magnolia* L. enters the stages of phenological development and duration: leaf opening, budding, flowering, fruit ripening, leaf fall, biological characteristics of the species, as well as meteorological climatic factors of the introduced region, especially depending on air temperature and relative humidity.

Magnolia grandiflora, *M. liliiflora*, *M. kobus* species belonging to the genus *Magnolia* have the ability to adapt to the conditions of Absheron, enter the biology of budding, flowering, fruit-

bearing, complete the vegetation, are suitable for use in decorative landscaping. In *M. liliiflora*, although fruit cones were formed and no seeds were obtained.

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