

**БИОТЕХНОЛОГИЯ ПРОДУКТОВ ПИТАНИЯ И БИОЛОГИЧЕСКИХ АКТИВНЫХ ВЕЩЕСТВ /  
BIOTECHNOLOGY OF FOOD AND BIOLOGICAL ACTIVE SUBSTANCES**

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**FEATURES OF THE BIOLOGY OF AN UNCONVENTIONAL SPICY-AROMATIC PLANT FOR THE REPUBLIC OF BASHKORTOSTAN *OCIMUM BASILICUM* L.**

Research article

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**Abstract**

The article presents data on the study of the seasonal rhythm of development and autecology of a non-traditional for the Urals (Russian Federation) species of spicy-aromatic plants – *Ocimum basilicum* L. – sweet basil in the conditions of the city of Birk of the Republic of Bashkortostan (Northern forest-steppe zone of the Southern Urals). The features and duration of the phases of the seasonal rhythm of plant development are described. The growing season is 150–180 days, the seeds ripen in August-September for 40–45 days. Seedlings appear 24–26 days after sowing. Then the plants develop rapidly and after 25–28 days the budding phase begins. The duration of flowering of sweet basil is 40–45 days. The central shoot blooms first on the plant, followed by the flowering branches of the first, second and subsequent orders. It is noted that the opening of flowers on a simple brush of inflorescence begins with the lower whorls and lasts from 12 to 18 days. For central shoots, the maximum flowering occurs during the first decade of flowering, for branches of the first order – during the second and third decades. It is shown that in the conditions of the city of Birk, in the Republic of Bashkortostan, plants form bushes with a large number of reproductive shoots and flowers. The potential seed productivity is quite high: shoots – 128–148 pieces of ovules; plants – 512–592 pieces, depending on the year of the study. The real seed productivity of shoots is less than the potential by 14-19%, and the real seed productivity of plants is less than the potential by 30-35%. The coefficient of seed productivity of plants is 65-70%, depending on the year of research. Thus, in the conditions of the temperate continental climatic zone of the Republic of Bashkortostan, *Ocimum basilicum* manages to go through a full cycle of seasonal development, has a good growth potential, high reproductive capacity and can be recommended for industrial cultivation.

**Keywords:** spicy-aromatic plants, *Ocimum basilicum* L., seasonal rhythm of development, flowering phase, anthecology, flowering dynamics, seed productivity, seed productivity coefficient.

**ОСОБЕННОСТИ БИОЛОГИИ НЕТРАДИЦИОННОГО ДЛЯ РЕСПУБЛИКИ БАШКОРТОСТАН ПРЯНО-АРОМАТИЧЕСКОГО РАСТЕНИЯ *OCIMUM BASILICUM* L.**

Научная статья

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**Аннотация**

В статье представлены данные по изучению сезонного ритма развития и анэкологии нетрадиционного для Урала (Российская Федерация) вида пряно-ароматических растений – *Ocimum basilicum* L. – базилика душистого в условиях г. Бирска Республики Башкортостан (Северная лесостепная зона Южного Урала). Описаны особенности и продолжительность фаз сезонного ритма развития растения. Вегетационный период составляет 150-180 дней, семена созревают в августе-сентябре в течение 40-45 суток. Всходы появляются через 24-26 суток после посева. Затем растения быстро развиваются и через 25-28 суток начинается фаза бутонизации. Продолжительность цветения базилика душистого – 40-45 суток. Первым на растении зацветает центральный побег, за ним начинают цветение ветви первого, второго и последующих порядков. Отмечено, что раскрытие цветков на простой кисти соцветия начинается с нижних мутовок и продолжается от 12 до 18 суток. Для центральных побегов максимум цветения наступает в период первой декады цветения, для ветвей первого порядка – в период второй и третьей декады. Показано, что в условиях г. Бирска Республики Башкортостан растения формируют кусты с большим количеством репродуктивных побегов и цветков. Потенциальная семенная продуктивность достаточно высокая: побегов – 128-148 шт. семян; растений – 512-592 шт. в зависимости от года исследования. Реальная семенная продуктивность побегов меньше потенциальной на 14-19%, а реальная семенная продуктивность растений меньше потенциальной на 30-35%. Коэффициент семенной продуктивности растений составляет 65-70% в зависимости от года исследований. Таким образом, в условиях умеренно-континентальной климатической зоны Республики Башкортостан *Ocimum basilicum* успевает пройти полный цикл сезонного развития, обладает хорошим потенциалом роста, высокой репродуктивной способностью и может быть рекомендован для промышленного выращивания.

**Ключевые слова:** пряно-ароматические растения, *Ocimum basilicum* L., сезонный ритм развития, фаза цветения, анэкология, динамика цветения, семенная продуктивность, коэффициент семенной продуктивности.

**Introduction**

Spicy-aromatic plants have been known to man since ancient times. Studying the properties of spicy-aromatic plants, people gradually expanded the scope of their application: spices began to be used as medicines, disinfectants, preservatives, cosmetics flavors. These plants are used for the treatment and prevention of various diseases. Many plants from this group are included in the modern pharmacopoeia. The need for such plants is growing. They are necessary in various industries and, above all, in the food industry [1], [2].

One of the most valuable spicy-aromatic plants is considered *Osimim*-a genus of annual and perennial grasses and shrubs of the Lamiaceae family [3].

The genus *Ocimum* is part of the *Ocimeae* tribe of the Nepetoideae subfamily of the family Lamiaceae of the order Lamiales.

The website of the Royal Botanic Gardens in Kew lists 69 species of the genus distributed in tropical and subtropical countries. Among them are *Ocimum basilicum* L., *Ocimum gratissimum* L., *Ocimum menthifolium*, *Ocimum tenuiflorum* L.

The most promising for plant medicine is *Ocimum basilicum* L. In folk medicine, the herb *O. basilicum* L. it is used for the discharge of sputum, as a reducing inflammation in kidney diseases and gastrointestinal diseases. Numerous studies have found that the essential oil of *O. basilicum* L. in the experiment has good antioxidant, antimicrobial and cytostatic activity. It was found that there are 11 components in its composition, the dominant of which are monoterpene alcohol- $\beta$ -linalool, phenolevgenol and sesquiterpengermacrene D [4].

The essential oils, glucosides, tonic and flavoring substances contained in *Ocimum basilicum* improve the culinary quality of products, change their consistency, making it more tender, excite the activity of the olfactory, gustatory and digestive organs, cause appetite, enhance the digestibility of nutrients, favorably affect their metabolism, the activity of the nervous and cardiovascular systems, etc. [5].

The purpose of our study was to study the features of the seasonal rhythm of development and the biology of flowering of an unconventional species of spicy-aromatic plants for the Urals – *Ocimum basilicum* L. of the Lemon variety in the conditions of the city of Birsks of the Republic of Bashkortostan (the Northern forest-steppe zone of the Southern Urals).

### Research methods and principles

The choice of the research object was based on the relevance and necessity of introducing into culture and studying the biology of the development of the species in the conditions of the Republic of Bashkortostan.

Seeds of *Ocimum basilicum* of the Lemon variety were sown in the spring of 2020, and in the same year the plants bloomed. We conducted observations of young generative plants. The plants were grown from seeds.

To monitor the development of the studied species, a plot of 5 m<sup>2</sup> was laid. The experimental plants were planted on a lighted area. The plants were planted in a square-nesting way (15×15 cm).

One model specimen was selected to study the biology of flowering. The study of the seasonal rhythm of development and seed productivity was carried out on 10 specimens of the studied species. Their growth and development were monitored according to the method of I.P. Ignatieva [6]. When studying the seasonal rhythm of development, observations were made on the timing of the onset of the main phases of plant development [7], [8], [9]. The processing of phenological dates was carried out according to the recommendations of G.N. Zaitsev [10], taking into account the additions of V.N. Nilov [11]. In the autecological studies, the provisions set out in the work of A.N. Ponomarev [12] were used. Seed productivity was determined according to the generally accepted method [13], [14]. The number of reproductive shoots, the number of flowers and fruits per reproductive shoot were taken into account on 20 plants of the same age. The number of seeds and ovules was counted in 100 fruits. By recalculation, the potential (number of ovules) and real (number of seeds) seed productivity of an individual was determined. According to the qualitative characteristics of seed productivity, the percentage of seedification (the percentage of the number of fruits and flowers of an individual) and the productivity coefficient (the percentage of real and potential seed productivity) were determined. The digital material was processed statistically according to the generally accepted method [15].

### Main results

*Ocimum basilicum* is a plant of a warm climate. Seeds are demanding of heat, light, moisture, and soil. At a temperature of 10-15°C shoots appear in 18-22 days, at a temperature of 15-20 °C-in 15-17 days.

Blooms in July-August, mass flowering occurs from the first decade of August. Identification of flowering features is an important link in the adaptation of plants in local conditions. Data on the study of the seasonal rhythm of development are shown in Table 1.

Table 1 - Seasonal rhythm of *Ocimum basilicum* development

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Phenological phases	Years of research	
	2020	2021
Seeding	17.05	01.06
Shoots	11.06	26.06
The beginning of budding	8.07	17.07
The beginning of flowering	18.07	27.07
Mass flowering	2.08 -12.08	12.08-25-08
Cleaning of inflorescences	5.08	15.08

Seed harvesting	03.10	10.10
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Seedlings appear 24–26 days after sowing. Then the plants develop rapidly and after 25–28 days the budding phase begins. Flowering of *Ocimum basilicum* begins in mid-July and lasts 40–45 days. The central shoot blooms first on the plant, followed by the branches of the first, second and subsequent orders begin to bloom.

The opening of flowers on a simple brush of the inflorescence begins with the lower whorls and lasts from 12 to 18 days, during the first decade of flowering of plants, 76-80% of the flowers of the entire inflorescence bloom. For central shoots, the maximum flowering occurs during the first decade of flowering, for branches of the first order – during the second and third decades. The growing season is 150–180 days.

The continuous opening of flowers on branches of all orders and the prolonged flowering of each shoot leads to a stretched flowering of the plant. The dynamics of flowering of one individual is shown in Figure 1. Flowering lasted for 42 days (Figure 1).

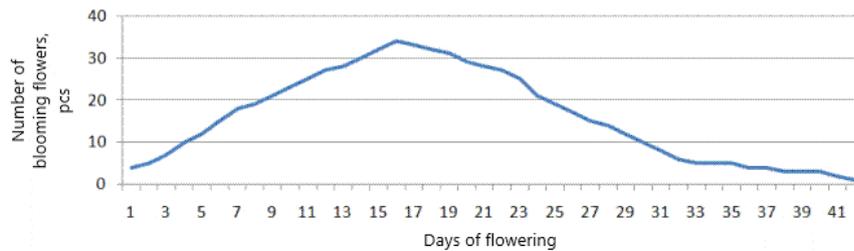


Figure 1 - Dynamics of flowering of *Ocimum basilicum* (2021)  
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We have studied in detail the dynamics of the appearance of blooming flowers during the entire flowering period on one individual.

We also conducted a study of morphometric indicators – the height of the plant, the number of reproductive shoots, the number of flowers and fruits on the plant, the height and diameter of the flower. The data is given in Table 2. *Ocimum basilicum* is a herbaceous plant with an average height of 51 cm. Each individual forms 4 shoots. There are approximately 32 flowers per shoot; individuals bear from 25 to 52 flowers. The diameter of the flower is from 0.3-0.9 cm, the maximum diameter of the flower is 1.1 cm. the percentage of flowering of the shoot is 81-83%. However, some shoots do not form flowers or form them in small quantities, so the percentage of fruit flowering of an individual of one plant is 65-66%. Thus, plants in the conditions of culture form bushes with a large number of reproductive shoots and flowers.

Table 2 - Morphometric indicators of *Ocimum basilicum*

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Indicators	Years of research	
	2020	2021
Plant height (cm)	51±3.03	49±2.28
Number of shoots per plant (pcs)	4±0	4±0
Number of flowers in the inflorescence (pcs)	32±0.7	37±0.7
The number of fruits on the shoot (pcs)	25±2	32±1
The percentage of fruit flowering of the shoot (%)	81±1.6	83±2.5
Percentage of fruit flowering of an individual (%)	65±1.4	66±1.5

Thus, individuals in the conditions of culture form bushes with a large number of flowers and reproductive shoots.

Under cultivation conditions, the seed productivity of *Ocimum basilicum* was studied. The data are given in Table 3. According to the data obtained, it can be noted that the number of ovules in the fruit is constant, and the number of completed seeds in the fruit is less than the number of ovules by 10%. The potential seed productivity is quite high: seedlings – 128–148 pieces of ovules; plants – 512–592 pieces, depending on the year of the study. The real seed productivity of shoots is less than the potential by 14-19%, and the real seed productivity of plants is less than the potential by 30-35%. Thus, the coefficient of seed productivity of plants is 65-70%, depending on the year of observation.

Table 3 - Seed productivity of *Ocimum basilicum*DOI: <https://doi.org/10.23670/IRJ.2023.133.46.4>

Indicators	Years of research	
	2020	2021
Number of ovules in the fruit (pcs)	4	4
The number of completed seeds in the fruit (pcs)	36±0.8	3.8±0.4
Potential seed productivity of the shoot (pcs)	12.8±2	148±4
Potential seed productivity of the plant (pcs)	512±1	592±11
Real seed productivity on the shoot (pcs)	104±4	128±3
Real seed productivity per plant (pcs)	336±24	416±16
The coefficient of seed of productivity on the plant (%)	65±0.05	70±0.016

### Conclusion

In culture, over two years of research, we can note an increase in the increase in potential and real seed productivity, as well as an increase in the coefficient of seed productivity. For the first time, the prehistory, seasonal rhythm of development and dynamics of flowering of the studied species in the conditions of the city of Birsik of the Republic of Bashkortostan were studied in detail.

Flowering of plants begins in mid-July and continues until the first autumn frosts, which stop the vegetation. The central shoot blooms first on the plant, followed by branches of the first, second and subsequent orders begin to bloom.

Plants in the conditions of culture form bushes with a large number of reproductive shoots and flowers.

As a result of studying the morphology and developmental biology of *Ocimum basilicum*, it was found that in the conditions of the temperate continental climatic zone of the Republic of Bashkortostan, this crop manages to go through a full cycle of seasonal development, has a good growth potential, high reproductive capacity and can be recommended for industrial culture.

### Конфликт интересов

Не указан.

### Рецензия

Все статьи проходят рецензирование. Но рецензент или автор статьи предпочли не публиковать рецензию к этой статье в открытом доступе. Рецензия может быть предоставлена компетентным органам по запросу.

### Conflict of Interest

None declared.

### Review

All articles are peer-reviewed. But the reviewer or the author of the article chose not to publish a review of this article in the public domain. The review can be provided to the competent authorities upon request.

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