

UDC 582.675.1
AGRIS F40

<https://doi.org/10.33619/2414-2948/128/01>

BIOLOGICAL AND ECOLOGICAL CHARACTERISTICS OF *Crocus sativus* L. GROWING IN AZERBAIJAN

©*Bakhshaliyeva A.*, ORCID: 0009-0001-9658-5589,
Nakhchivan State University, Nakhchivan, Azerbaijan, arzukeyimli85@gmail.com
©*Ibrahimova A.*, ORCID: 0000-0001-5713-6740, Ph.D.,
Nakhchivan State University, Nakhchivan, Azerbaijan, a.ibrahimova@yahoo.com

БИОЛОГИЧЕСКИЕ И ЭКОЛОГИЧЕСКИЕ ОСОБЕННОСТИ *Crocus sativus* L. ПРОИЗРАСТАЮЩЕГО В УСЛОВИЯХ АЗЕРБАЙДЖАНА

©*Бахшалиева А.*, ORCID: 0009-0001-9658-5589, Нахчыванский государственный университет, г. Нахчыван, Азербайджан, arzukeyimli85@gmail.com
©*Ибрагимова А. М.*, ORCID: 0000-0001-5713-6740, канд. биол. наук, Нахчыванский государственный университет, г. Нахчыван, Азербайджан, a.ibrahimova@yahoo.com

Abstract. This research investigates the biological, chemical, and agro-climatic characteristics of the saffron plant (*Crocus sativus* L.) in the conditions of Azerbaijan. It was determined that saffron, in addition to being a vegetatively propagated plant of high economic value, is also widely used in both food and medical fields thanks to its bioactive compounds, such as crocetin, picrocrocin, and safranal. In the Nakhchivan region, certain species are found in the wild and are commonly known as ‘sarychichek’ or ‘chagalagül’. Certain representatives of these species, found in the mountainous areas of the region, are used in traditional medicine for various ailments, including kidney disorders, gynaecological problems, inflammation of the lymphatic vessels (lymphangitis), and skin infections (furunculosis). Research has shown that Nakhchivan's arid and sunny climate, and its light, well-drained soils, create optimal conditions for saffron's development. Mild temperatures, particularly during the autumn months, extend the flowering period, positively affecting both yield and the quality of the stigmas. At the same time, the proper application of agronomic measures, such as sowing depth, irrigation regime, and the regular renewal of corms, plays a crucial role in maintaining yields. Research also shows that the quality characteristics of saffron vary depending on the cultivation conditions. Furthermore, the slow rate of vegetative propagation and a low level of mechanisation have been identified as the main factors hindering the expansion of production. In the Nakhchivan region, sufficient corm reserves have not been established for the commercial cultivation of saffron. For this reason, there remains a need to secure planting material (corms) from external sources to expand production. The saffron plant is propagated by corms, not by seeds. These bulbs are planted in the ground and bloom in the autumn, typically between October and November. Inside each flower are three slender, deep-red stigmas, and it is this part that is dried to form saffron, one of the most expensive spices in the world. The correct assessment of agro-climatic factors, the application of modern biotechnological approaches, and the use of scientifically-based agronomic methods are considered a promising direction for increasing the yield and quality of saffron.

Аннотация. Представлены биологические, химические и агроклиматические характеристики растения шафрана (*Crocus sativus* L.), произрастающего на территории

Азербайджана. Шафран широко используется как в пищевой, так и в медицинской отраслях благодаря своим биологически активным соединениям, таким как кроцетин, пикрокроцин и сафранал. В Нахчыванском регионе некоторые виды встречаются в дикой природе и широко известны под названиями «сарычичек» или «чагалагуль». Некоторые представители этих видов, встречающиеся в горных районах региона, используются в народной медицине для лечения различных заболеваний, включая почечные расстройства, гинекологические проблемы, воспаление лимфатических сосудов (лимфангит) и кожные инфекции (фурункулез). Климат Нахчывана — это оптимальные условия для развития шафрана. Мягкие температуры, особенно в осенние месяцы, продлевают период цветения, положительно влияя как на урожайность, так и на качество рыльцев. Применение агротехнических мер поддерживает высокую урожайность растения. Качественные характеристики шафрана варьируются в зависимости от условий выращивания. Основные факторы, сдерживающие развитие растения — это низкая скорость вегетативного размножения и низкий уровень агротехники. Растение шафрана размножается клубнелуковицами, а не семенами. В Нахчыванском регионе не создано достаточных запасов клубнелуковиц для коммерческого выращивания шафрана. По этой причине для расширения производства по-прежнему существует необходимость в обеспечении посадочного материала (клубнелуковиц) из внешних источников. Клубнелуковицы зацветают осенью, обычно в период с октября по ноябрь. Внутри каждого цветка находятся три тонких рыльца насыщенно-красного цвета, и именно эта часть после сушки дает шафран — одну из самых дорогих специй в мире. Правильная оценка агроклиматических факторов, применение современных биотехнологических подходов и использование научно обоснованных агрономических методов считаются перспективным направлением для повышения урожайности и качества шафрана.

Keywords: saffron, spice, agricultural technology, Azerbaijan.

Ключевые слова: шафран, пряность, агротехнология, Азербайджан.

Saffron (*Crocus sativus* L.) is a triploid perennial bulbous plant, considered one of the most valuable spices in the world. One of the biological characteristics of this plant is its inability to reproduce by seed; for this reason, saffron is only propagated vegetatively, that is, through the division of corms. Its high economic value is mainly due to the bioactive substances contained in the dried product obtained from the flower's female organ — the red stigmas. Compounds such as crocin, picrocrocin, and safranal, present in saffron, give the product its characteristic colour, taste, and aroma. These components also possess potent antioxidant, anti-inflammatory, and neuroprotective effects, making saffron widely used in various fields, including the food industry, medicine, and cosmetology. Historical sources indicate that saffron cultivation began approximately 3,000 years ago, initially spreading throughout Asia Minor and Iran. Subsequently, the plant spread widely to the Mediterranean region, India, and Europe. In modern times, the leading countries in saffron production include Iran, India, Spain, Greece, Morocco, and Azerbaijan [5, 11].

Saffron grown in Azerbaijan, particularly on the Absheron Peninsula, is distinguished by its high quality and richness in safranal. However, the cultivation of saffron is accompanied by certain agronomic challenges. The plant's inability to produce seeds due to being triploid necessitates its propagation solely by vegetative means. This, despite the limited genetic diversity, ensures the stability of the varieties. The development of saffron is directly dependent on soil and climatic conditions. The plant develops best in sunny, well-drained soils, with a mild climate and a dry

summer. At the same time, the quality of the harvested product, particularly the biochemical composition of the stigmas, is closely linked to these factors. Thus, saffron is considered an important strategic crop, both in terms of its biological characteristics and its economic importance. Studying the cultivation characteristics of saffron under Azerbaijani conditions, the factors affecting its yield, and its economic efficiency contributes to establishing the scientific basis for the development of this sector.

Materials and Methods

The research was conducted in the Nakhchivan Autonomous Republic during 2023–2024. Local saffron corms of the species *Crocus sativus* L. were used as the research material. The plants were planted at a depth of 20 cm in September, and during the growing season, irrigation, weeding and soil cultivation were carried out. Nakhchivan's continental and arid climatic conditions, long hours of sunshine, and light-textured soils proved favourable for the development of the saffron plant. The mild autumn temperatures prolonged the flowering period, which had a positive effect on the yield [11, 12].

Results. Discussion of the Study

The results of the study show that the biological, chemical and agro-climatic characteristics of the saffron plant (*Crocus sativus* L.) directly affect its yield and quality indicators. Observations conducted in the Nakhchivan Autonomous Republic have confirmed that saffron is well-adapted to the climatic and soil characteristics of this region [11, 12].

The research determined that sunny weather, light-textured soils and good drainage are optimal for the vegetative development and flowering of the saffron plant. The mild temperature during the autumn months led to an extension of the flowering period, which in turn had a positive effect on the number and quality of the stigmas. Biochemical analyses have shown that the content of crocin, picrocrocin and safranal, the main quality indicators of saffron, is significantly dependent on the cultivation conditions. A prolonged period of sunshine and arid climatic conditions have facilitated the greater accumulation of these substances in the stigmas. This has led to an enhancement of the product's colour, flavour, and aromatic properties [10].

The correct application of agronomic measures has also had a significant impact on yield. The correct selection of sowing depth and plant spacing, along with irrigation and soil cultivation during the growing season, ensured the normal development of the plants. At the same time, the renewal of the corms every 3–4 years was identified as an important factor for maintaining yield.

The research results have shown that one of the main limiting factors in saffron production is the relatively slow vegetative propagation, the low level of mechanisation, and the failure to renew the corms in a timely manner. These factors lead to a decrease in yield and a limited production volume. A comparative analysis has determined that saffron from Azerbaijan, particularly that grown in the Nakhchivan and Absheron regions, is competitive in terms of quality with saffron from Iran, Spain and Turkey. This indicates that there is great potential for the expansion of saffron production in the country.

Furthermore, the results of molecular-biological studies indicate that regulating the expression level of genes involved in the biosynthesis of crocetin and safranal (CsZCD, CsCCD2) could enable the development of higher-quality and more productive varieties in the future. Overall, the results obtained indicate that the application of agroclimatic factors, proper agronomic measures, and modern biotechnological approaches in saffron cultivation plays a crucial role in increasing yield and quality parameters. Nakhchivan's climate can enhance both the yield and quality of saffron. This is precisely why Nakhchivan is considered very favourable for saffron cultivation. In particular, the dry

summer season in Nakhchivan, The prolonged sunshine and mild autumn conditions accelerate the vegetative development of the saffron plant, optimise the flowering process, and create favourable conditions for the accumulation of biologically active substances, particularly crocin and safranal, in the stigmas. However, there are some important points to consider, namely a proper irrigation regime, good soil drainage, and the timely renewal of the bulbs (Table).

Table

CONDITIONS FOR THE DEVELOPMENT OF SAFFRON

<i>Factor</i>	<i>Demand for Saffron</i>	<i>Nakhchivan conditions</i>	<i>Adaptation</i>
Temperature	15–25°C	Summer hot, autumn mild	Suitable
Precipitation	Light (300–500 mm)	Low rainfall	Suitable
Sunny	High	Very high	A perfect match
Summer season	Dry	Dry and hot	Perfect fit
Soil	Light, well-drained	Suitable	Suitable

The plant's corm is approximately 2–3 cm in diameter and is renewed each year. Its leaves are narrow, fragrant and dark green. The flowers open in autumn, and the flowering period lasts for only 2–3 weeks [4].

Each flower has three bright red stigmas and yellow anthers; it is these stigmas that are dried and used as a spice [1].

The root system is weak, located 20–30 cm deep in the soil. Saffron prefers a hot, dry, sunny climate and light, well-drained soil. It is prone to root rot in damp and heavy soils [5].

The plant's chemical composition mainly includes crocin (the colouring pigment), picrocrocin (the flavouring substance) and safranal (the aromatic component). These substances form the unique aroma, flavour and colour characteristics of saffron [2].

Crocus cultivation in Azerbaijan has a very ancient history. Literature indicates that saffron has been cultivated on the Absheron Peninsula for over a thousand years [6].

In particular, in villages such as Bilgah, Zabrat, and Pirshagi, saffron production has developed as a traditional agricultural activity [5].

Six species of the genus *Crocus* have been recorded in Azerbaijan, but the only one used as a spice is *Crocus sativus* L. [9].

The Absheron lands are considered the most favourable for saffron: the warm spring and dry autumn weather conditions facilitate a high accumulation of aromatic components in the stigmas [6].

The aroma strength and colour of Azerbaijani saffron are considered to meet international quality standards [5].

However, the production volume is still limited; one of the main problems is the lack of bulb renewal, poor mechanisation and weak market linkages [6].

Saffron cultivation in other countries and a comparison: Iran provides over 90% of the world's saffron production [7].

In the Gonabad region, saffron is cultivated using a traditional water-wheel system, which has been recognised by the FAO as a “Global Agricultural Heritage System”. Iranian saffron is distinguished by its high crocetin content and intense colour [2, 3].

In Spain, the main saffron-producing region is the province of La Mancha. Here, saffron has a European Union “Protected Designation of Origin” status [8, 9].

Spanish saffron is characterised by its paler colour, but aromatic and balanced flavour [2].

In Turkey, saffron is mainly cultivated in the Karabük–Safranbolu region. This region takes its name, “safran”, from the plant. Turkish saffron is distinguished by its richness in phenolic compounds and its antioxidant activity [2, 4].

Cultivated saffron is a perennial herb up to 0.2 m in height. Saffron is one of the most famous plants in the world; what makes it so famous are the stigmas inside its flower. The Assyrians and Babylonians were aware of the irremplacable medicinal value of these stigmas since ancient times. The three stigmas are reddish-orange in colour. The dried stigmas of saffron are used as a spice in various dishes. In folk medicine, its infusion and spirit are used to treat various illnesses. In Eastern medicine, saffron has been used as a key ingredient in over 300 medicinal preparations made from various plants. In Azerbaijan, the dried threads of saffron are used in the preparation of more than 50 confectionery products. When a watery solution of saffron is added to meat and fish dishes, the resulting dishes not only have a pleasant colour but are also tasty and fragrant. Six species of saffron are found in Azerbaijan. One of these, *Crocus sativus* L., is cultivated. Until recently, cultivated saffron was only grown at the Bilgah sovkhov in Absheron. As the saffron produced on the sovkhov no longer fully met the demand of the republic's population, an agronomic method for cultivating saffron was developed in several districts of our republic on the initiative of the "Bioflor" Inter-Branch Scientific and Technical Complex and the State Planning Committee [10, 12].

The soil for planting saffron should be light and sandy. Yields will be better if 20 tonnes of well-rotted manure is applied per hectare. Planting should be done at a depth of 5-12 cm, with 20-30 cm between plants and 10-15 cm between rows. If the weather is dry after planting, a single, thorough watering is advisable. During the growing season, irrigation, application of fertilisers (in July and August), weed control and cultivation of the inter-row soil should be carried out. The saffron flowers in October–November. In the first year after planting, the plants produce 2-3 or more light purple flowers. The flowers are picked in the morning, and the stigmas are separated from them. The collected threads are dried at a temperature of 18-22°C in a place away from direct sunlight. When dried in this way, the collected threads can retain their aroma and colour for a long time. It is advisable to store the prepared saffron threads in airtight glass containers. If these rules are followed, it can be kept for 10-15 years without losing its quality. The dried saffron petals can also be brewed with tea and drunk. The corm bulbs should be lifted from the ground when the above-ground leaves are completely dry. This is approximately in May. The corms of the planted saffron should be lifted, cleaned, and sorted by size every 3-4 years, and then either planted or stored in a cool, dry place until the time of planting. If left in the ground for too long, the corms will become less productive and start to break down. Anyone who follows these guidelines can grow saffron at home or in their own garden. Its delicate flowers will not only adorn your room, but 3-5 of its threads will also colour your dishes a deep-yellow and give them a wonderful flavour (<https://707.su/efGV>).

Infusing the dried stigmas, a mixture with honey, plucking the stigmas when the flower is fresh and placing them under the tongue, or scraping the inside of an apple and filling it with the mixture are all beneficial for the brain cells, in addition to having a positive effect on the blood vessels, it prevents their calcification, and helps in the treatment of diseases of the retina, cataracts, jaundice, liver, gallbladder, heart attacks, and gastrointestinal diseases. It gives the body strength, vigour and courage. The stigmas of saffron are used as an invaluable medicinal remedy for infertility, while the dried flower petals are used as an expectorant (<https://707.su/efGV>).

An infusion of the dried stigmas is used for jaundice, gallbladder and liver diseases. For this, 7-15 well-dried saffron stigmas are taken and brewed like ordinary tea in a glass beaker, or an enamelled or porcelain teapot with boiling water. First, rinse the teapot with boiling water and pour it out. Then, add 7-15 dried threads to the teapot, pour in a cup of boiling water, stir with a teaspoon, and place it on a low heat. After 3-5 minutes, they add the remaining two cups of water, stir, and leave it to brew. When the flower buds settle to the bottom of the teapot, it indicates the infusion is ready. A cup can be drunk 30 minutes before breakfast, lunch and dinner. When the infusion is finished, do not discard it; instead, pour in boiling water, brew it again and drink it. For eye diseases,

5 dried saffron threads are added to a clean, washed glass, 2 tablespoons of boiling water are added on top, and it is left to infuse by the gas or a hot oven. After 10-15 minutes, the infusion turns a bright yellow colour. Two to three drops are applied to a clean (sterile) cotton wool ball and the eye is wiped with it in the morning and evening. You should wipe the eye 3 times on the first day, 5 times on the second, 7 times on the third, and 10 times on the fourth. During this treatment, the eye's vision improves significantly (<https://707.su/efGV>).

5 well-dried (in the shade at 18-20°C) saffron stigmas are crushed into a powder. Then, a paste is prepared by mixing in an equal amount of rosewater. Applying this ointment to the eye treats all diseases that form within it. For pneumonia, headaches, and heart palpitations, one “Golden Delicious” apple is taken, the top is cut off like a lid, and the centre is scooped out. Care should be taken not to damage the apple's skin, and to leave a little of the flesh. Next, 10 well-dried threads of saffron are placed inside, and the apple is covered with the lid cut from the top and left to stand for 24 hours. Every three hours, the lid should be opened and the aroma inhaled. It is advisable to do this 5 to 10 times. This will strengthen your memory, nourish your brain, relieve headaches and improve your mood. It also helps well with tuberculosis and a heart palpitation (<https://707.su/efGV>).

For kidney stones, take 100 grams of pure honey and pour it into an enamel dish, it is melted over a gentle heat, 50 saffron threads, crushed into a powder, are added, and it is mixed thoroughly. A teaspoonful is taken in the evening or in the morning. For insomnia and headaches, 100 grams of olive oil and 50 threads of saffron, well crushed into a powder, are taken and mixed with 200 grams of well-sifted wheat flour and kneaded. Applying this soft, kneaded ointment as a compress to the painful area of the head relieves headaches and is very beneficial for insomnia (<https://707.su/efGV>).

Like many medicinal plants, saffron also has its adverse effects. Although this plant has many benefits, excessive use of saffron can cause a number of harms to the body. If taken in excess of 1 gram per day, it can cause dizziness, nausea and allergic reactions. For pregnant women, consuming large quantities of saffron can increase the risk of miscarriage. Saffron can also lower blood pressure in people who already have low blood pressure. Herbalists note that saffron should be used as a spice, not a medicine. A very small amount of saffron is sufficient in daily meals. Thus, saffron has a miraculous effect for both health and beauty, but it must be used correctly (<https://707.su/efGV>).

The bioactive compounds in saffron — crocin, safranal, picrocrocin, kaempferol and flavonoids — have various medicinal effects. Studies show that saffron extract regulates serotonin levels and has an antidepressant and calming effect by reducing symptoms of mild depression [2].

Crocin and safranal act as antioxidants and anti-cancer agents by neutralising free radicals, thereby reducing cell damage and slowing the growth of malignant cells [7].

Saffron improves lipid profiles, lowers blood cholesterol levels, and increases vascular elasticity, exerting a cardioprotective effect. Crocin is used in ophthalmology as it has a protective effect against age-related macular degeneration by reducing photoreceptor damage to the cells of the retina [8, 10].

Safranal has neuroprotective and reproductive properties, enhances memory, and also has a hormone-balancing effect [2].

Saffron is also used in folk medicine to treat a number of diseases; it is widely used for gastrointestinal disorders, the common cold, insomnia and menstrual pain [1].

Grind the saffron, take half a teaspoonful and add 1 cup of boiling water. The saffron water is ready. Pour the water into a small, dark glass bottle and store in the fridge. Take 1 tbsp of the medicinal saffron water twice a day before meals. Take 1 tbsp of this mixture twice a day before meals. This recipe strengthens the heart (<https://707.su/efGV>).

Saffron Syrup comes from ancient Azerbaijani cuisine. It supports eye health, the nervous system, and digestion, and has antioxidant properties. Ingredients: 3-4 saffron threads. 1 litre of water. 2 tablespoons of honey (or sugar). 2-3 cloves of cloves. A few drops of lemon juice (optional).

Water (a very small amount, for an aromatic effect). Preparation: 1. Soak the saffron in 2-3 tablespoons of lukewarm water for 4-5 hours (to release its colour). 2. Boil 1 litre of water, then add the saffron water, cloves and honey. 3. Simmer on a low heat for 5-7 minutes. 4. Remove from the heat, allow to cool and strain. 5. Add lemon juice or a few drops of rose water, if desired. It can be served cold or warm (<https://707.su/efGV>).

Recent research in molecular biology aims to improve saffron quality by studying apocarotenoid biosynthesis and the expression of the CsZCD and CsCCD2 genes in *Crocus sativus* [8].

These genes play a key role in the synthesis of crocetin and safranal, making genetic selection and in vitro micropropagation techniques important avenues [7].

Conclusion

Saffron (*Crocus sativus* L.) is one of the strategic crops with high biological, economic and pharmacological importance. Its value is mainly determined by its bioactive compounds, crocin, picrocrocin and safranal. These compounds give the spice its unique colour, flavour and aroma, and also exhibit antioxidant, anti-inflammatory and neuroprotective properties. Studies show that the chemical composition of saffron is directly influenced by the soil and climatic conditions in which it is grown. Nakhchivan's continental climate, high sunshine and light-textured soils create a favourable environment for the saffron's vegetative development and flowering. Meanwhile, mild autumn temperatures extend the flowering period, allowing the levels of safranal and crocin in the stigmas to increase. Azerbaijani saffron, particularly the varieties grown in the Absheron regions, is of a quality comparable to that of Iran, Spain, and Turkey. Nevertheless, saffron production in the country remains limited; the main challenges include slow vegetative propagation, the failure to renew the corms in a timely manner, and a low level of mechanisation. Research in molecular biology and biotechnology indicates that the regulation of the expression of the CsZCD and CsCCD2 genes plays a crucial role in the biosynthesis of crocetin and safranal. In the future, combining this knowledge with breeding and in-vitro micropropagation technologies will facilitate the development of high-yielding genotypes. The use of saffron in folk medicine and modern medicine further confirms its pharmacological importance. Studies show that saffron extract regulates serotonin levels, has antidepressant and sedative effects, improves lipid metabolism, has a positive effect against cancer, and protects the visual system. In Azerbaijani folk medicine, saffron is widely used in the treatment of cardiovascular, liver, kidney and eye diseases. Consequently, saffron is one of Azerbaijan's plants with strategic importance and significant natural and economic potential. In the Nakhchivan region, improving cultivation technology, scientifically optimising agronomic measures, and applying biotechnological methods can significantly increase the productivity of saffron production. This approach can contribute to Azerbaijan's "green economy" strategy by strengthening domestic market security and increasing export potential.

References:

1. Khorasany, A. R., & Hosseinzadeh, H. (2016). Therapeutic effects of saffron (*Crocus sativus* L.) in digestive disorders: a review. *Iranian journal of basic medical sciences*, 19(5), 455.
2. Amanpour, A., Soltani, M., Lipan, L., Garcia-Garv, J. M., Hernandez-Garca, F., Carbonell-Barrachina, . A., & Nadal, E. S. (2024). Comparative study on nutraceutical and sensorial

characteristics of saffron (*Crocus sativus* L.) cultivated in Iran, Spain, and Türkiye. *Journal of the Science of Food and Agriculture*, 104(12), 7580-7591. <https://doi.org/10.1002/jsfa.13594>

3. Kumar, R., Singh, V., Devi, K., Sharma, M., Singh, M. K., & Ahuja, P. S. (2008). State of art of saffron (*Crocus sativus* L.) agronomy: A comprehensive review. *Food Reviews International*, 25(1), 44-85. <https://doi.org/10.1080/87559120802458503>

5. Karbasi, A., & Zandi Dareh Gharibi, B. (2022). Economic aspects of saffron in the world. In *The saffron genome* (pp. 275-287). Cham: Springer International Publishing.

6. Golmohammadi, F. (2019). Saffron as a main cash, medical and resistive plant for sustainable economy and livelihood of rural people in dried regions of Iran. *Black Sea Journal of Agriculture*, 2(3), 156-163. <https://izlik.org/JA76AC83TX>

7. Mirbakhsh, M. (2022). In vitro micropropagation and apocarotenoid gene expression in saffron. *ArXiv preprint arXiv:2208.13292*. <https://doi.org/10.48550/arXiv.2309.11513>

8. Shams, Z. (2023). Gene expression patterns of CsZCD and apocarotenoid accumulation during saffron stigma development. *arXiv preprint arXiv:2309.11513*.

9. Abbasov, N. K. (2024). New distribution area of the species *Crocus adamii* J. Gay (Iridaceae) (Azerbaijan, Nakhchivan AR). *Azerbaijan Journal of Botany*, 2(2), 25-28.

10. Mehdiyeva, N. P., Alizade, V. M., Salimov, R., & Mursal, N. (2025). The Flora and Vegetation of Azerbaijan. In *Ethnobotany of the Caucasus* (pp. 81-129). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-319-50009-6_16-2

11. Ahrazem, O., Rubio-Moraga, A., Nebauer, S. G., Molina, R. V., & Gomez-Gomez, L. (2015). Saffron: its phytochemistry, developmental processes, and biotechnological prospects. *Journal of agricultural and food chemistry*, 63(40), 8751-8764. <https://doi.org/10.1021/acs.jafc.5b03194>

12. Mammadov, T. M., & Huseynova, N. R. (2020). Improvement of saffron cultivation technology under Nakhchivan conditions. *Nakhchivan State University Scientific News*, (3), 40-47.

Список литературы:

1. Khorasany A. R., Hosseinzadeh H. Therapeutic effects of saffron (*Crocus sativus* L.) in digestive disorders: a review // Iranian journal of basic medical sciences. 2016. V. 19. №5. P. 455.

2. Amanpour A., Soltani M., Lipan L., Garcia-Garvi J. M., Hernández-García F., Carbonell-Barrachina Á. A., Nadal E. S. Comparative study on nutraceutical and sensorial characteristics of saffron (*Crocus sativus* L.) cultivated in Iran, Spain, and Türkiye // Journal of the Science of Food and Agriculture. 2024. V. 104. №12. P. 7580-7591. <https://doi.org/10.1002/jsfa.13594>

3. Kumar R., Singh V., Devi K., Sharma M., Singh M. K., Ahuja P. S. State of art of saffron (*Crocus sativus* L.) agronomy: A comprehensive review // Food Reviews International. 2008. V. 25. №1. P. 44-85. 4. A scent of saffron. Region Plus, 2023. <https://doi.org/10.1080/87559120802458503>

5. Karbasi A., Zandi Dareh Gharibi B. Economic aspects of saffron in the world // The saffron genome. Cham: Springer International Publishing, 2022. P. 275-287.

6. Golmohammadi F. Saffron as a main cash, medical and resistive plant for sustainable economy and livelihood of rural people in dried regions of Iran // Black Sea Journal of Agriculture. 2019. V. 2. №3. P. 156-163. <https://izlik.org/JA76AC83TX>

7. Mirbakhsh M. In vitro micropropagation and apocarotenoid gene expression in saffron // ArXiv preprint arXiv:2208.13292. 2022. <https://doi.org/10.48550/arXiv.2309.11513>

8. Shams Z. Gene expression patterns of CsZCD and apocarotenoid accumulation during saffron stigma development // arXiv preprint arXiv:2309.11513. 2023.

9. Abbasov N. K. New distribution area of the species *Crocus adamii* J. Gay (Iridaceae) (Azerbaijan, Nakhchivan AR) // Azerbaijan Journal of Botany. 2024. V. 2. №2. P. 25-28.

10. Mehdiyeva N. P., Alizade V. M., Salimov R., Mursal N. The Flora and Vegetation of Azerbaijan //Ethnobotany of the Caucasus. – Cham : Springer Nature Switzerland, 2025. P. 81-129. https://doi.org/10.1007/978-3-319-50009-6_16-2

11. Ahrazem O., Rubio-Moraga A., Nebauer S. G., Molina R. V., Gomez-Gomez L. Saffron: its phytochemistry, developmental processes, and biotechnological prospects // Journal of agricultural and food chemistry. 2015. V. 63. №40. P. 8751-8764. <https://doi.org/10.1021/acs.jafc.5b03194>

12. Mammadov T. M., Huseynova N. R. Improvement of saffron cultivation technology under Nakhchivan conditions // Nakhchivan State University Scientific News. 2020. №.3. P. 40–47.

Поступила в редакцию
01.05.2026 г.

Принята к публикации
09.05.2026 г.

Ссылка для цитирования:

Bakhshaliyeva A., Ibrahimova A. Biological and Ecological Characteristics of *Crocus sativus* L. Growing in Azerbaijan // Бюллетень науки и практики. 2026. Т. 12. №7. С. 12-20. <https://doi.org/10.33619/2414-2948/128/01>

Cite as (APA):

Bakhshaliyeva, A., & Ibrahimova, A. (2026). Biological and Ecological Characteristics of *Crocus sativus* L. Growing in Azerbaijan. *Bulletin of Science and Practice*, 12(7), 12-20. <https://doi.org/10.33619/2414-2948/128/01>