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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

INTRODUCTION OF SOME SPECIES AND VARIETIES OF *IRIS L.* INTO ABSHERON

Speciality: 2417.01-Botany

Field of science: Biology

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GENERAL DESCRIPTION OF WORK

Relevance of the work. The introduction of ornamental plants of world flora is one of the most important research fields in modern botanical gardens. The introduction of new species not only expands the range of beautiful flowering and ornamental foliage plants for greenery,but also keeps biodiversity in nature, preserving, restoring and reproducing rare and endangered species in natural flora.

In recent times the importance of greening of cities and towns is becoming more important due to the complication of the environmental situation in the world. As a result of the influence of anthropogenic factors the ecological environment of cities and towns is aggressive enough for plants.This necessitates the selection of plants grown in urban environment that are more resistant not only to climatic but also to anthropogenic factors that require deep scientific research.

The assortment of flowering, ornamental perennial herbs in the world is of particular interest due to their diverse shape, color, and ability to adapt to the most unfavorable climatic conditions. Therefore, ornamental perennial herbs are the basis of assortments of ornamental plants used in the greening of parks, streets and in landscape design work in cities and towns. The species and varieties of *Iris* L. have a special place among perennial ornamental plants.

Botanical description of types and varieties of *Iris* L., the study of its bioecological characteristic in cultured conditions, the study of its morphogenesis, growth and development dynamics, biomorphological statistical analysis of iris types, estimation of decoration and selection of promising assortments;working out their cultivation agrotechniques, information about the development of their cultivation and identification of the most promising types and varieties for gardening are reflected in the works by E. Spach[1], W.R. Dykes[2], B. Matthew[3], I.P. Ignatyeva[4], J.W. Waddick, Y. Zhao[5], N.A.

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[1] Spach, E. Revisio generis *Iris* L. // Ann. Sci. Nat. - 1846. Ser.3, №5. - p. 89-111.

[2] Dykes, W.R. The Cenus *Iris* / W.Rdykes. - Mineola. New York, Dover publications, incorporated, - 1974. - 245 p.

Mamayeva, I.V. Vasilyeva[6], I.V. Burlakova[7], N.B. Alekseyava[8], P. Goldblatt, J.C. Manning[9], I.V. Shevchenko[10].

The genus of *Iris* L. has a special place among the perennial ornamental grasses that have been introduced into the dry subtropical conditions of Absheron. The scientific information about the bioecological features of the species and varieties cultivated in Absheron, their ontogenesis, morphogenesis, seed productivity, biomorphological statistical analysis and the study of decorative indicators are scarce or incomplete. Therefore, it is one of the relevant topics to identify the possibility of cultivation of this genus *Iris* L in order to expand the range of wild ornamental species and cultural varieties.

Iris genus is one of the most popular perennial ornamental plants among the decorative flowers. Currently, "more than 40,000 officially registered types of this genus have been created"[11]. Many botanical gardens and research institutes in foreign countries are

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[3] Matthew, B. The *Iris*. A classification of Iris by Mathew / B. Matthew - London: - 1981. - 202 p.

[4] Игнатьева, И.П. Онтогенетический морфогенез вегетативных органов травянистых растений / И.П.Игнатьева. - Москва: Московская сельхоз. академия им. К.А. Тимирязева, - 1983. - 55 с.

[5] Waddick, J.W. *Iris* L. of China / J.W.Waddick, Y.Zhao, - Oregon: Portland, - 1992. - 192 p.

[6] Мамаева, Н.А., Васильева, И.В. Биология и эволюция цветка ириса // Сб. студенч. науч. работ. Московский селско-хозяйственный академии, - 2000. вып. 6. - с. 30-35.

[7] Бурлакова, И.В. Ирисы / И.В.Бурлакова, В.К.Зыкова. - Москва: ЗАО «Фитон», - 2006. - 208 с.

[8] Алексеева Н.Б. Иридарий Ботанического сада Ботанического института им. В.Л.Комарова РАН /Н.Б.Алексеева. - СПб: - 2009, -144 с.

[9] Goldblatt P. The iris family / P. Goldblatt, J.C. Manning, - London: Timber Press, - 2008. - 290 p.

[10] Шевченко, И.В. Биоморфологические особенности видов и сортов *Iris* L. в культуре юге среднерусской возвышенности: / Автореферат диссертация кандидат биологических наук) / - Белгород: - 2013. - 19 с.

[11] Родионенко, Г.И., Алексеева, Н.Б. Коллекция видов и культиваров семейства Касатиковых // Растения открытого грунта Ботанического сада Ботанического института им. В.Л.Комарова. - Санкт-Петербург: - 2002. - с. 151-166.

engaged in the introduction of irises. However, the number of scientific researches dedicated to the introduction of the types and varieties of Iris in the arid subtropical condition of Azerbaijan is very few.

Investigation of the biomorphological characteristics of the iris species under cultivation allows to identify their cultivation characteristics and to evaluate the phenotypic differences between the varieties of different garden groups.

The study of the bioecological and biomorphological features of the species and varieties of the Iris genus studied in new environmental condition, the dynamics of its growth and development, the biomorphological statistical analysis of its types and agrotechniques of the species are of great importance.

Object and subject of research. The object of research is 5 species and 16 varieties of *Iris* L.

The aim of the work. The main purpose of our research is to study the bioecological and biomorphological features, morphogenesis, growth and development dynamics of species and varieties of *Iris* genus introduced into the dry subtropical conditions of Absheron, to conduct a biomorphological statistical analysis, to estimate their decoration and to select promising assortments,to develop agrotecniques for their cultivation and identify the most promising types and varieties for gardening.

The following tasks have been set to achieve this goal:

- To create a collection of species and varieties of *Iris* genus;
- To study the morphogenesis and development cycle of species and varieties in ontogenesis;
- To study morphology and dynamics of development of underground and surface parts of the species and varieties of Iris;
- To study the phenology (vegetative, flowering and fruit-bearing) of the investigated species and varieties;
- To carry out biomorphological statistical analysis of the species of Iris;
- Coding of color shades of *Iris* species with RGB color model and its clustering with the k-mean algorithm;

- To evaluate successful and decorative introduction of varieties and types of irises in dry subtropical conditions of Absheron,working out practical recommendations for their cultivation.

The research methods. The phenological observation, determination of viable forms and seed productivity, evaluation of decorativeness,the study of morphogenesis and life cycle, determination of the quality and morphological structure of pollen, comparative analysis of the morphological characteristics of flower elements, methods of clustering of varieties with the k-mean algorithm,as well as mathematical calculation methods were used in this research.

The main provisions submitted to the defense.

1. Different morphological features of perennial ornamental species provide effective greening and landscape composition.
2. The economic justification for seed and vegetative reproduction is a criteria for the success of introduction and use of ornamental perennial plants in the dry subtropical conditions of Absheron.
3. The morphological features of the structures of surface and underground sprouts in Iris species,the rhythm of their development, the structure and morphological features of their separate parts reflect the diversity of their ecological and geographical origin.

Scientific novelty of the work. The ontogenesis of 5 wild species and 16 varieties of Iris genus in culture conditions of Absheron, the rhythm of seasonal development, flowering dynamics, biological characteristics of seed germination, seed yield, biomorphological statistical analysis of varieties, color coding with the RGB color model and clustering with the k-mean algorithm were studied in detail for the first time. Agrotechnical methods of their cultivation were worked out. The current state of the Iris collection in Central Botanical Garden was assessed. The causative agents of irises were identified and the success of their introduction was evaluated. Promising species and varieties were identified and recommendations for their use in greening were given.

It was identified that in the studied Iris species vegetation lasted 84-226 days whereas in the varieties 92-109 days.

For the first time the color of the flowers, the dynamics of the development of various elements during vegetative stage from the beginning of flowering to full bloom were observed and the comparative analysis of the morphological features of flower elements of the varieties were made and in this case the following parameters were measured: the width and length of the flower, the width and length of the inner and outer petals, and the length of the stalk and pollen of stamen. This comparison allows to identify varieties with similar and different sizes.

Theoritical and Practical relevance of the work The evidence obtained in the study of the development rhythm ,the beginning and the duration of flowering, the sequence of flowering in the species and varieties under observation are of particular importance in the greening and flower compositions. Proposed species and varieties can be added to plant assortments used in greening. There are 2 varieties and 6 types of iris that have high decorative indicator and economic and biological characteristics for use in greening of cities and towns in Absheron. Proposed varieties and types allow to form continuously blooming flower gardens.

Approbation of work. The main results of the dissertation were reported at an international seminar "Role of environmental assessment of agricultural land in developed of regions and in protection of ecological balance" (Baku, 2015), "Academic Science Week-2015" at the international multidisciplinary forum (Baku, 2015), "Actual problems of science of the XXI century" VII international scientific-practical conference (Moscow, 2016), "Actual problems of modern nature and economic sciences" international scientific conference (Ganja, 2018), "Applied Analysis and Mathematical" VIII international conference (Istanbul-Turkey, 2019), also at the seminar council of the Central Botanical Garden and the Botanical Institute.

Organization where dissertation work is performed. The research work was carried out according to a research plan at the laboratory "Rare and Endangered Plants" of Institute of Botany and Central Botanical Garden.

Publications. As a result of research conducted in 2009-2019, 12 works were published, reflecting the main provisions and results of the dissertation. 5 of these works are conference materials and 7 are research papers. Two of the articles were published in periodicals included in the list of the Russian HAC, and the others in local and foreign journals.

Structure of the dissertation.

The dissertation consists of an introduction, [9314 symbols], literature review [Chapter I (34493 symbols), Chapter II (8525 symbols)], the description of research material and methodology [Chapter III (12641 symbols)], presentation of results and their interpretations [Chapter IV (43315 symbols), Chapter V (16144 symbols), Chapter VI (102473 symbols), main results (2687 symbols), agricultural recommendation (2649 symbols), 266 literary references (36124 symbols). The dissertation is illustrated with 14 tables, 51 figures. The volume of the dissertation is 190 pages of computer text, the total volume is 268365 symbols.

MAIN CONTENT OF THE DISSERTATION

Literature review. Overview of the dissertation consists of 2 chapters.

Chapter 1. Systematic, morphological characterization and introduction of *Iris* L. genus. In this part of the work, chronological analysis of scientific studies on the history of systematization, morpho-biological characterization, botanical-geographical features and intruders of the *Iris* L. genus is presented.

Chapter 2. Conditions, object and methodology of research. This chapter gives a brief description of the natural conditions of Absheron and the main environmental factors (climate, soil, vegetation) of the conditions in which the species and varieties of iris are introduced.

The researches were carried out in 2012-2018 in the field of the experimental laboratory "Rare and Endangered Plants" of the Central

Botanical Garden of ANAS. Studies were conducted on 5 species and 16 varieties of *Iris L.* genus.

Morphological features and seasonal development of the studied plants were determined according to the "Methodology of phenological observations in the Botanical Gardens of the USSR"[12], the definition of the type of phenorhythm according to I.V.Borisova's classification [13] vital forms according to the method of I.Q.Serebryakov[14]. Ontogenetic development was studied using the method of T.A. Rabotnov[15] and I.I. Ignatieva[16].

The seed yield of the studied plants was determined according to the method of I.V. Vaynagi[17]. In determining the success of the plant introduction, V.V. Bakanova's "*7-point scale, designed for flowering decorative perennials,*"[18] was used.

A list of *Iris L.* genus species and their natural habitat, which has been widely distributed in the flora of Azerbaijan, has been parsed by A.A. Grossheim[19], "The Flora of Azerbaijan"[20], O.V.Ibadly[21] and A.M. Asgarov[22]. The names of Iris species and

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12 Методика фенологических наблюдений в ботанических садах СССР. - Москва: ГБС АН СССР, - 1975. - 27 с.

13 Борисова, И.В.Сезонная динамика растительного сообщества / И.В.Борисова Полевая геоботаника. – Ленинград: Наука, - т. 4. - 1972. -с.5-94.

14 Серебряков, И.Г. Экологическая морфология растений / И.Г.Серебряков.- Москва: Высшая школа, - 1962. - 378 с.

15 Работнов, Т.А. Жизненный цикл многолетних травянистых растений в луговых ценозах // Тр. БИН АН СССР, - 1965. Сер. 3. № 6, - с. 7-204.

16 Игнатьева, И.П. Онтогенетический морфогенез вегетативных органов травянистых растений / И.П.Игнатьева. - Москва: Московская сельхоз. академия им. К.А. Тимирязева, - 1983. - 55 с.

17 Вайнагий, И.В. О методике изучения семенной продуктивности растений // Ботан. журн. - 1974. Т. 59. № 6, - с. 826-831.

18 Баканова, В.В. Цветочно-декоративные многолетники открытого грунта/ В.В.Баканова. - Киев: Наука, - 1984, - 155 с.

19 Гроссгейм, А.А. *Iris* L. / Флора Кавказа. - Баку: АН Аз. ССР, - 1940, т. 2, - 284 с.

20 Флора Азербайджана. [в 1-8 томах] / Под ред. Д.И.Сосновского. - Баку: АН Азерб. ССР, - 1953, - с. 317.

21 İbadlı, O.V. Qafqazın geofitləri. - Bakı: Elm, -2002. - s. 126.

22 Əsgərov, A.M. Azərbaycan florasının konspekti /A.Əsgərov. - Bakı: Elm, -2011.

varieties are listed according to internet site of "*The Plant List*"[23] "*The International Plant Gardening Association's Plant Database*"[24], and *"The Iris Encyclopedia of the American Iris Society*" [25].

The morphogenesis and life cycle of the iris species and varieties studied were studied based on the methods proposed by I.G. Serebryakov[26] and F.M. Kuperman[27].

It was used to describe the pollen of the Iris varieties from the terminology proposed by L.A. Kupriyanova[28] and G. Erdtman[29], to determine the quality and morphological structure of pollen by Z.P. Pausheva[30], while the method of germination and viability was used by I.N. Golubinskiy[31] method.

Comparative analysis of the morphological features of the flower elements of the moss species was carried out using C. McEwen's "*RHS CC standart*"[32]

Based on the methods used by Edvin Paul[33], M.Kulig[34] and

- 204 s.

[23] http://www.theplantlist.org/browse/A/Iridaceae/Iris/

[24] http://www.garden.org/plants/

[25] http://www.wiki.irises.org/

[26] Серебряков, И.Г. Экологическая морфология растений / И.Г.Серебряков.- Москва: Высшая школа, - 1962. - 378 с.

[27] Куперман, Ф.М. Морфофизиология растений / Ф.М.Куперман. - Москва: Высш. школа, - 1968, - 223 с.

[28] Куприянова, Л.А. Сем. *Iridaceae* Juss. Касатиковые / Споры папоротникообразных, пыльца голосеменных и однодольных растений флоры европейской части СССР. - Ленинград: Наука, - 1983, - с. 114-120.

[29] Erdtman, G. Pollen morphology and plant taxonomy Angiosperm / G.Erdtman. - Stockholm: Almquist Wiksell, - 1952. - 539 p.

[30] Паушева, З.П. Практикум по цитологий растений / З.П.Паушева. - Москва: Агропром, - 1988. - 271с.

[31] Голубинский, И.Н. Биология прорастания пыльцы / И.Н.Голубинский. - Киев: Наукова думка, - 1974. - 368 с.

[32] McEwen C. Methods for inducing tetraploidy in siberian and japanese irises // Bulletin American Iris Society, - 1978. № 223, - p. 20-23.

[33] Edwin, P.J. Tozer / P.J. Edwin. - Broadcast Engineer`s reference Book, Elsevier. - 2004 - p.179.

[34] Kulig, M. Characteristics of flowers of selected *Iris* species and varieties from *Limniris* section // Electronic Journal of Polish Agricultural Universities (Ejpau), - 2012. vol. 15, №1, 04, - p. 10.

Y.Gurskiy and others[35], the colors of the iris varieties were studied, and the RGB graphical coding of the inner and outer petals was performed. The clustering of *Iris* varieties with the k-mean algorithm was studied using the methods proposed by R.A. Fisher[36] and M. Schonlau[37].

Mathematical calculations were based on the methods proposed by T.A. Babayev and etc.[38] and G.N. Zaytsev[39] .

Experimental part. This part of the dissertation consists of 4 chapters.

Chapter 3. Botanical characterization of the studied species and varieties of Iris under Absheron conditions. This chapter presents a botanical description of the species and varieties of the Iris genus introduced in the dry subtropical conditions of Absheron under new environmental conditions.

Chapter 4. Morphogenesis and development cycle of some of the noble species and varieties introduced into Absheron conditions. This chapter presents the results and interpretations of the morphogenesis and development cycle of some species and varieties of the Iris genus introduced in Absheron, the morphology and development dynamics of underground bodies, and the growth and development dynamics of the studied species and varieties.

The morphogenesis and development cycle of some species and varieties of Iris introduced into Absheron's dry subtropical conditions have been studied extensively. Given the morphological similarity of the stages of the ontogenesis of Iris and the

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[35]Гурский, Ю. Компьютерная графика: Photoshop CS3, Corel DRAW X3, Illustrator CS3. Ю.Гурский, И.Гурская, А.Жвалевский - Питер: - 2008. - 175 с.

[36]Fisher, R.A. The use of multiple measurements in taxonomic problems // - Annals of Eugenics, - 1936. **7** (2), - p. 179–188.

[37]Schonlau, M. The clustergram: a graph for visualizing hierarchical and non-hierarchical cluster analyses // The Stata Journal, - 2002. 2, 4, - p. 391-402.

[38]Babayev, T.Ə. Hesablama texnikasının və ekspermentin riyazi nəzəriyyəsinin elmi tədqiqiatlarda tətbiqi / T.Ə. Babayev, A.R.Bünyatov, Q.C. Əfəndiyev [və b.] - Bakı: Elm, - 1999. - 102 s.

[39]Зайцев, Г.Н. Математическая статистика в экспериментальной ботанике. / Г.Н.Зайцев. Отв. ред. член.-корр. ВАСХНИЛ В.Н.Былов, - Москва: Наука, - 1984. - 419 с.

morphological similarity in the studied species and varieties, they have been summarized in an example of the *I. reticulata* species (Figure 1) and *I. 'Five Star Admiral'* (Figure 2).

As a result of the research, it was determined that the ontogenetic process in the species and varieties of iris grown in Absheron conditions is stable and undergoes a full development stage. Studies have shown that the species and varieties studied are very similar to virgin and generative development. The species and varieties

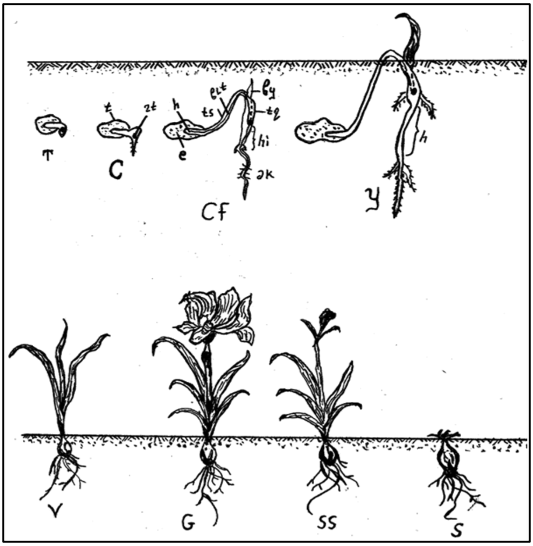
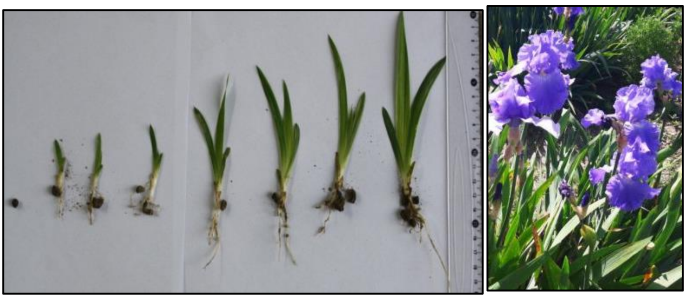


Figure 1. The main phases of the ontogeny of I reticulata:
S- seed, G-germination, SP - sprouting (t - seed,
rs-rheumatic shoot, e- endosperm, h- haustoria, st-seed stem, tfb-tubular fiber ball, fl-first leaf, ss-seed sheath, h-hypocotyl, ms- main stem), J-juvenile phase, V-virginal phase, G-generative phase, SS-subsenyl phase,
S-senile phase.

studied differ only by the morphometric dimensions of the organs. The germination of the seeds in the Irises refers to the underground germination type. Seeds were sown in October. Sown seeds began to swell in late February, early March, and in mid-March. The seed germinates early in the seed. Although the root stem is first developed from the brush, at the same time there are also 2-5 additional roots. The root system is fringed in Irises. After 4-7 days of root formation, the bud develops and the first leaf is formed. Two or four ribbon leaves are formed in the juvenile phase. Although they differ in size from the leaves of an older plant, they do not differ in shape or structure. The root system of ten-year-old seedlings of the *I. reticulata* species was 4.5 cm, the surface area was 7.8 cm, the leaves were 4.5 cm long, and 1.3 cm wide. The root system of the *Iris* 'Five Star Admiral' is 5.6 cm in length, its surface height is 11.2 cm, its leaves are 7-10 cm long and 1.8 cm wide. The surface height of the monthly seedlings of the studied plants was 8–24 cm and the root was 7–10 cm. In early May the growth and development of the I. reticulata species and from early June to *Iris* 'Five Star Admiral' stops. By the end of May, in mid-June, the surface area will begin to dry up and the plant will begin to cool down. The first year of development of the studied species and variety is 60-85 days. In the studied species and varieties of Iris, the juvenile phase lasts 3–4 years in the root form and 2–3 years in the bulb forms.



S G GF J GS

Figure 2. The main stages of ontogeny of the *Iris* 'Five Star Admiral' variety: S- seed, G- germination, GP - germination, J - juvenile phase, GS - generative stage.

In the second year of March, the plants begin to germinate and in the middle of March and early April, they reach the top of the soil. With the formation of monopodial branching, bulb and root growth in juvenile plants, the juvenile phase moves to the immature phase. Immature Stage *I. reticulata* is observed in mid-April of the second year, and *Iris* 'Five Star Admiral' in late May. In the third year of development, the older vegetative stage of ontogenesis begins with branching and the first bush formation. The older vegetative stage is observed in the third year of vegetation in the *I. reticulata* species (in the second decade of March), and in the *I.* 'Five Star Admiral' in the middle of the fourth year of vegetation (in the second decade of April).

In the third year of development, in the middle of March, generative shoots of type *I. reticulata* begin to develop. Generally, the type *I. reticulata* differs from other moss species and species due to its low use in virginil and generative stages, and the small number of vegetative and generative Irises. The mature generative stage is observed for the fourth year in type *I. reticulata,* and the sixth in the *I.* 'Five Star Admiral' variety. In the mature generative stage, the size of the shoots, flowers, fruits, and seeds, the intensive differentiation of root and shoots reaches maximum. At this stage, the number of generative spots is 1-4. In the adult generative stage, flowering begins earlier than in the young generative stage. *I. reticulata* begins to blossom in mid-March, and *I.* 'Five Star Admiral' from early May. In the generative stage of ontogenesis, the species and varieties studied show a decrease in the number, height, number and size of vegetative and generative shoots. The age-old generative stage begins at the age of 15-20 in type *I. reticulata*, and in the *Iris 'Five Star Admiral'* age 35-40. According to our research, we can say that root-grown rhizomes move into the late generative stage compared to bulbouses.

Thus, it should be noted that the studied species and varieties of Irises generally undergo all periods and stages of ontogeny in the dry subtropical conditions of Absheron and can be widely used in gardening and ornamental work.

Chapter 5. Biomorphological statistical analysis of iris varieties. This chapter provides a comparative analysis of the morphological characteristics of the studied varieties, coding of color shades of varieties with RGB color model and clustering of varieties with k-means algorithm and their interpretation.

Phenological observations were made during the growing season from budding to full flowering, the color of flowers, the development dynamics of the size of various elements were monitored, the morphological characteristics of the flower elements of iris varieties were compared using the RHS CC standard. During the study, the following parameters were measured - the width and length of the flower, the width and length of the inner and outer petals, and the length of the stalk and pollen of the male.

The range of width and length of the inner and outer petals of the studied Iris varieties was determined. The stamen size variations are similar or insignificant in all of the studied Iris species. Thus, It is observed that the minimum stamen length is 2.5 cm in *I.* 'Batic' and the maximum is 3.1 cm in the *I.* 'Lilac Domino' variety. The stamen length variability is also low in individuals of all sorts. Thus, the highest variance was 9.1% and was observed in the *I.* Night Ruler, with the least variation being 1.9% in the *I.* Footloose variety.

In all the Iris sorts studied, the stamen deflection was longer than dusty. The longest stalks were observed in the *I.* 'Lilac Domino' with 2.1 cm, and the shortest stalks were found in the *I.* 'Thriller' variety of 1.4 cm. *Iris* varieties also have little variation in dust lengths. The highest variation is observed in the *I.* 'Night Ruler' variety and is 9.3%. The longest anther is observed in the *I.* 'Lilac Domino' (1.5 cm) variety.

Iris varieties are estimated by the variety of colors and sizes of their flowers.

The width and length of flowers of the iris species studied in Absheron, the width and length of the inner and outer petals, the shape and size of the stamen differ.

Coding of Iris varieties with RGB color model. The colors of the iris varieties introduced into the CBG were studied, and the RGB graphical coding of the inner and outer petals was performed. Images of iris varieties are based on computer coding - a component theory of three primary colors (Red, Green and Blue). By mixing these colors in a certain proportion, one can get any other color that the human eye can accept, the absence of any color gives black, and the presence of all three colors gives 100% white. In most graphic editors, in addition to the palette offered by the user editor, it is possible to create multiple color shades by changing the brightness of the colored dots. The basis of this study is the Corel DRAW program, one of the graphic editors, which encodes images of iris varieties in the appropriate RGB color model and records the number (ratio) of each color that identifies the code. Typically, graphic editors create the required color with 256 shades of red, green and blue.

In the Corel DRAW graphics editor, the RGB color model is additionally provided with a three-dimensional coordinate system. In this system, the zero point corresponds to black and the coordinate axes to the primary colors. The value of each of the three coordinates indicates the value of the primary colors in the final shade. A visual representation of the flowers, along with computer codes, and basic information about each variety allow for a full explanation of the topic. Due to their tendency to hybridize, the colors of iris flowers vary widely.

The results of the study on the coding of color shades of iris varieties with the RGB color model allow to determine the colors of the inner and outer petals of 14 iris varieties introduced to the CBG. These results make it easy to correctly match colors to images in any graphics editor.

Clustering of Iris varieties with the k-mean algorithm. The morphological features of the 9 iris varieties introduced into the CBG have been studied by cluster method. The following parameters were used during the study: the width and length of the inner and outer petals. This, in turn, provides a comparative analysis of the morphological features of the species. The most widespread k-average clustering algorithm from cluster methods has been applied by means of statistical programming language R. In the study, a k-mean cluster model was created in R statistical programming language based on the width and length characteristics of the inner and outer flowers of the 9 iris varieties. Descriptive statistics of indicators of each variety, cluster centers and their scatter 3d graph, Gaussian distribution graph, boxplot graph are constructed. Finding the measurement components that make up a cluster are the main results of a cluster analysis of statistical research.

Chapter 6. Bioecological features of iris species and varieties in Absheron conditions. This chapter of work presents the phenology of iris species and varieties studied in Absheron conditions, the study of pollen, flowering and fruiting characteristics, the results obtained during seed and vegetative propagation and their interpretation.

Phenological observation on the studied species and varieties was carried out on the phases of germination, formation of generative shoots, budding, flowering, formation and maturation of fruits and seeds, end of vegetation.

Iris reticulata blooms first among the irises studied. Other types of irises bloom in the second and third decades of April. Early-growing iris varieties bloom in the first decade of May, while late-growing varieties bloom mainly in the second decade of May. The duration of flowering in iris species and varieties studied in Absheron conditions varies between 15-35 days, depending on the biological characteristics of the plant. The surface of the studied iris species dries completely 14-25 days after ripening. Vegetation in the dry subtropical conditions of Absheron lasted 84-101 days in the studied iris species, and 226 days in the *I*. musulmanica species. In the studied iris varieties, vegetation lasted 92-109 days.

Thus, it has been determined that the beginning of vegetation in iris species and varieties in Absheron conditions covers the period from the beginning of the second decade of March to the beginning of the second decade of April, budding from March 15 to June 16, flowering from the second decade of April to the second decade of June. The duration of flowering varies from 15 to 35 days. The lifespan of the resulting flowers is 12-20 days, in iris species and 17-25 days in varieties. Fruits appear 18-25 days after flowering. Seeds begin to ripen 10-18 days after fruiting. The end of the vegetation period covers the period from the first decade of June to the third decade of July. Vegetation in iris species lasted 84-101 days, and in varieties 92-109 days.

Study of pollen of iris varieties. During the research as a result of the analysis of morphometric characteristics of pollen, it was determined that the pollen of iris varieties differ greatly in shape, size and productivity. It was found that the pollen of the studied varieties is single-protruding, shallow, multi-polar, bilaterial-symmetrical, hertopolar, ellipsoidal. The exine part is mesh. In addition to the analysis of the morphometric characteristics of the pollen of the studied iris varieties, their viability was also studied.

Flowering and fruiting features. The studied iris species and cultivars are characterized by low seed productivity in Absheron conditions. Seeds are formed in each of the box fruits of iris species and varieties. However, most seeds are not fully developed and mature. Most seeds go through developmental stages and dry out before they are fully formed. The study of flowering and fruiting characteristics of iris species and varieties introduced to the dry subtropical conditions of Absheron shows that the studied plants normally carry out the budding, flowering, fruiting and seeding periods of the generative stage.

Propagation of iris species and varieties by seed and vegetative methods. In Absheron conditions, the optimal burial depth of seeds of iris species and varieties is 2-3 cm, and the best sowing time is in the Fall, the second and third decade of October. Thus, when comparing the germination rate of seeds sown at different times and depths, the highest rates were observed on October 15, in seeds sown to a depth of 2-3 cm. In autumn, the seeds of iris species sown on October 15 yield 38-73%, the seeds of varieties yield 19-36%. As can be seen, the seeds of the iris species studied in the Absheron conditions are more productive than the varieties. The iris reproduces easily vegetatively.

Agrotechnics of cultivation of iris species and varieties in Absheron conditions. Irrigation species and varieties introduced to the dry subtropical conditions of Absheron were given agro-technical care rules, pest and disease control measures, economic-biological significance, analysis of decorative features and results obtained during the assessment of introduction prospects and their interpretation.

Collection and storage of planting material. Irises are reproduced by seeds and vegetative means. Under Absheron conditions, the seeds of the iris species grow mainly in the first and second decades of June, and the seeds of the varieties grow from the second decade of June to the second decade of July. The ripened seeds are solid and have dirt, edges, flat, various angles, pale, brown, golden, dark yellow, brown and chestnut. As soon as the seeds have matured, the berries are opened, some of the seeds are scattered around, and some are stuck to the walls of the box. The iris species investigated are characterized by low seed productivity under Absheron conditions. For sowing Iris seeds in autumn and spring, it is advisable to keep in a mix of 2 parts sand and 1 part soil, with relative humidity of not more than 45-60% and temperature of 3-7^{0}C. Iris seeds retain germination capacity for 2-3 years.

Vegetative reproduction of varieties and sorts of the iris is more effective. When the surface of the plant begins to dry, it is advisable to remove the root or bulbs from the soil and collect it for planting material. In the mature generative stage, Irises have a high germination capacity. The collected Iris rootstocks and bulbousess should be stored at a temperature of 4-7^{0}C, in a mixture of sand and soil, at a ratio of 1:1 to sowing. *Iris* species and varieties can be transferred to different locations during different vegetation periods under Absheron conditions.

*Selection of arable land and soil preparation.*The varieties and sorts of iris are mainly cold-tolerant, light-weighted and not so demanding for soil fertility. Although irises do not require soil fertility, it is more advisable to select relatively dry, soft and humus-rich soils during the introduction. In the areas selected for the cultivation of *Iris*, it is necessary to add 3: 1 sand in the autumn and sprinkle manure and leaves at a depth of 30-40 cm.

Determination of time and order of sowing. Under the Absheron conditions, the optimal seeding time of seeds of the breed of Iris species and varieties is the second and third decade of October, with an optimum germination depth of 2-3 cm. Seeds of iris species should be sown at intervals of 10-15 cm and varieties of 25-30 cm. At the same time, seeds of the iris species produce 38-73%, and seeds of the varieties - 19-36%. It was found that the seeds of the iris should be sown in the third decade of February, 2-3 cm. At this time, the percentage of germination is higher in the spring compared to the seeds sown at different times and depths (22-51% in species, 12-26% in varieties).

The results of the studies show that the optimal time for vegetative reproduction of iris species and varieties under Absheron conditions is late September, early October, and late February.

Irises develop and bloom more rapidly as they reproduce by vegetative methods. It is advisable to plant between the rootstock and bulb species of the pollen species studied at 10–20 cm, the interval between 15–25 cm, the distance between the root species of the species 30–35 cm, and the distance between the roots 40–45 cm.

Plant maintenance and irrigation regimes. The seed should be irrigated after sowing, seedling and bulbous. At a later stage, the irrigation and maintenance regimes should be maintained as follows:

- In the germination and juvenile stages of the pregenerative period of vegetation the plant should be watered 10 times, climbing 7-8 times and loosening the bottom;

- pumping 8 times in immature and virgin stages, climbing 5-6 times and loosening the bottom;

- watering 5 times during the young generative phase of the generative cycle, climbing 4-5 times and loosening the bottom;

- watering 3-4 times in the adult generative and adult generative stages, climbing 2-3 times and loosening the bottom.

It is advisable to irrigate iris 1-2 times in March, April, and 3-4 times in May, June and July. In the pregenerative period, irises should be fertilized 1-2 times during the growing season and 2-3 times during the generative period. The area should be watered after fertilizing the plants.

Diseases, pests and measures to combat them. Diseases and pests of suspected genus species and varieties introduced under Absheron conditions were identified and measures to combat them were developed. Phytopathological studies have shown that fungal diseases are more prevalent than bacterial and viral diseases. *Botyris convoluta* and *Sclerotium rolfsii* fungi produce gray and moist rot in various organs of the iris. The rust disease is found in many varieties and sorts of Iris which caused by *Pucciniairidis* fungus.

RESULTS

1. For the first time, a collection made of 5 species and 16 varieties was studied for bioecology, ontogenesis, seasonal development, biomorphological statistical analysis and agro-technical characteristics of the genus *Iris L*. in dry subtropical conditions of Absheron.

2. Intensive growth in species and varieties of iris is observed from the beginning of the III decade of April to the middle of the II decade of May. Vegetation lasts 84-226 days in iris species, and 92-109 days in varieties. *I. reticulata* blooms in the second decade of March, whereas the remaining species in the second and third decade of April, and varieties in the first and second decade of May.

3. *Iris reticulata* type of the Iris species are fully grown in the first decade of May and other types and varieties by the third decade of June. There are 15 to 40 seeds in the loculicidal capsules of the studied species and 15-75 ones in the varieties.

4. During the generative development, a comparative analysis of the morphological characteristics of the flowering elements of iris varieties was carried out using the RHS CC standard, measuring the following parameters - width and length of the flower, length of the flower stalk, width and length of the inner and outer petals, stalk and pollen. The comparison of the obtained results allowed to identify varieties with similar and different sizes.

5. As result of graphical coding of the color shades of the inner and outer petals of flowers, some varieties of irises are grouped as follows: 1. One-color: all petals with the same color, varieties with lines of color on their own – (*I.* 'Five Star Admiral', *I.* 'Night Ruler', *I.* 'Orange Jubile', *I.* 'Smiling Angel', *I.* 'Thriller'); 2.Two-toned: top and bottom of flower petals with different shades of the same color (*I.* 'Batic', *I.* 'Revolution' *I.* 'Unforgetable Fire', *I.* 'Brown Lasso'); 3. Two colored:the varieties of the upper and lower parts of the petals with different shades of the same color -(*I*. 'Champagne Elegance', *I*. 'Starlight Express', *I*. 'Lilac Domio' and *I*. 'Valor').

6. The k-means cluster algorithm of the cluster method was investigated with the morphological features of 9 iris varieties ('*I*.

Five Star Admiral', *I*. 'Batic', *I*. 'Charmpagne Elegance', *I*. 'Footloose', *I*. 'Lilac domino', *I*. 'Night Ruler', *I*. 'Thriller', *I*. 'Valor', *I*. 'Brown Lasso') using the R statistical programming language. This allowed to make a comparative analysis of the morphological features of the studied varieties.

7. The Iris genus can be classified into the following three groups according to the perspective of species and varieties in Absheron condition: 1. Most promising ones – 13-15 points (*I. alexeenkoi, I. musulmanica, I*. 'Batic', *I.* 'Champagne Elegance', *I.* 'Five Star Admiral', *I.* 'Lilac Domino', *I.* 'Unforgettable Fire' and *I.* 'Valor'); 2. Promising ones – 9-12 points (*I. caucasica, I. grossheimii, I. reticulata, I.* 'Brown Lasso', *I.* 'Crown Sterling', *I.* 'Footloose', *I.* 'Night Ruler' *I.* 'Orange Jubile', *I.* 'Revolution', *I.* 'Smiling Angel', *I.* 'Sunny Afternoon' and *I.* 'Thriller') 3. Less promising ones – 5-8 points (*I.* 'Starlight Express').

AGRICULTURAL RECOMMENDATIONS

1. The results obtained during the study of the ontogenesis, bioecological features, and methods of reproduction of 5 species and 16 varieties of *Iris L*. introduced to Absheron conditions give reason to say that they can be widely used in the landscaping of cities and settlements, gardening and artificial landscaping.

2. The studied species and varieties of irises are easily propagated generatively and vegetatively without the need for special conditions. Seed propagation is mainly used during hybridization and introduction of species. It should be borne in mind that during the propagation by seed, irises bloom in 2-4 years. The studied iris species and cultivars are characterized by low seed productivity in Absheron conditions. Therefore, when the seeds are ripe, 2 parts sand and 1 part soil mixture are used for sowing in autumn and spring as planting material, choosing healthier and larger ones, it is recommended to keep the seeds at a temperature of 3-7°C, with a relative humidity of no more than 45-60%.

3. Vegetative propagation of species and varieties belonging to the genus Iris is more promising, they bloom in the first or second

year. For this purpose, at the end of the growing season, it is advisable to collect the roots and bulbs of mature plants without damaging them. Roots and bulbs of irises should be kept in a mixture of sand and soil in a ratio of 1:1 before planting, at a temperature of 4-7 degrees.

4. Given the biological characteristics of irises, it is advisable to plant them in sunny, dry, soft and humus-rich soils. In autumn, the planting area should be plowed to a depth of 30-40 cm by adding sand in a ratio of 3: 1 and giving manure and leaf rot. When sowing seeds, rhizomes or onions, it is advisable to apply 30-35 g of superphosphate fertilizer per 1 m^2.

5. In Absheron conditions, the best sowing time for seeds of iris species and varieties is in the second and third decade of October in autumn, the optimal sowing depth is 2-3 cm. Seeds of iris species should be sown with 10-15 cm between rows, and varieties with 25-30 cm. In this case, the seeds of iris species yield 38-73%, and the seeds of varieties yield 19-36%.

The best time for vegetative propagation is late September, early October in autumn and March in spring. It is expedient to plant the irises of the studied iris species with a distance of 10-20 cm between the roots and bulbs, 15-25 cm between the rows, 30-35 cm between the roots of the varieties, and 40-45 cm between the rows. 65-90% of onion and root crops of iris species planted in autumn and 55-75% of root crops of varieties germinate in autumn.

6. In Absheron conditions, the best time to transplant *Iris L.* species and varieties is the beginning of vegetation and the end of vegetation. 15-20 days after the start of vegetation, the time of formation of leaves and vegetative shoots is considered more favorable.

THE MAIN CONTENT OF THE DISSERTATION IS STATED IN THE FOLLOWING PUBLICATIONS:

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