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STUDY OF THE GENOME DIVERSITY OF *Cornus* L. AND *Mespilus* L. CULTIVATED IN THE NORTHERN REGIONS OF AZERBAIJAN

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ИЗУЧЕНИЕ ГЕНОМНОГО РАЗНООБРАЗИЯ КИЗИЛА И МУШМУЛЫ, ВОЗДЕЛЫВАЕМЫХ В СЕВЕРНЫХ РАЙОНАХ АЗЕРБАЙДЖАНА

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Abstract. Cranberry and medlar are common in the Guba, Gusar, and Sheki regions of Azerbaijan. A study was conducted to determine the habitats of wild growing forms and biomorphological features. Identification was carried out based on molecular markers. A comparative study of the biomorphological characteristics of genotypes, economic indicators, pomological analysis and assessment of similarity by quantitative indicators was carried out.

Аннотация. Кизил и мушмула распространены в Губинском, Гусарском, Шекинском районах Азербайджана. Для определения ареалов дикорастущих форм, биоморфологических особенностей проведено исследование. Проведена идентификация на основе молекулярных маркеров. Выполнено сравнительное изучение биоморфологических особенностей генотипов, экономических показателей, помологического анализа и оценки сходства по количественным показателям. На основании полученных результатов подготовлены характеристики изучаемых растений и рекомендации по эффективному использованию в селекционных программах.

Keywords: molecular marker, genome, trait, genotype, antioxidant.

Ключевые слова: молекулярный маркер, геном, признак, генотип, антиоксидант.

Cornus L. is a plant genus belonging to the Cornaceae family. Cornaceae trees of the same age growing in forest areas have different forms in appearance, such as bushes and trees. They are dense and tall in light areas where the trees are sparse, the umbrella is developed around, and they have a low and skinny trunk in thick forest. According to literature data, dogwood (*Cornus mas* L.) tree has a lifespan of about 300 years. The fruits are round, oval, pear-like and cylindrical in shape, the color is red, dark red, black red, and some forms are light yellow. Dogwood (*Cornus mas* L.) fruit is completely different in size, shape and color. Wild Cornaceae seeds in the forest are small, one grain weighs 2-5 grams, and one grain of cultivated Cornaceae in gardens weighs up to 20-22 grams. The aroma of fruits depends on the content of essential oil [1].

The taste is sour or sweet-sour, the taste of a fully ripe Cornaceae becomes sweet due to the effect of biochemical processes. Fruits contain 22-25% glucose, fructose, sucrose, 11-12%, organic acids: lemon, malic, amber, folate, etc., 7-8% vaccine, carotene and vitamin E, B₁, B₂, dye 0.

Contains 62-1.6% pectin substances, 17% antioxidants, 1.14 amino acids, 1.3% cellulose, 1.18% mineral substances: iron, calcium. Since it contains up to 55 mg of vitamin C, it is used in medicine against scurvy and many other diseases. Due to the high content of tannins in unripe fruits, it has the ability to astringent the mouth. Kernels contain 30% fat, are very hard, and kernel ends can be swollen or blunt. Blooms in February-March long before it leaves. The yellow flowers are gathered together and hang like an umbrella. The fruits ripen in late August and September. Fruit is used by humans as food fresh, dried and cooked. Prevents cancer of the brain, lung, and intestine, regulates the amount of insulin, is useful for heart diseases, and helps to eliminate urinary tract infection. Useful for kidney stones. acidifying properties dissolve stones, prevent bacteria from sticking together, and eliminate infection. Freshly fruit and juice are used in folk medicine for diabetes. It is used as a medicine against diarrhea and dysentery in children by roasting the grass and turning it into a powder. In general, in the folk medicine of Azerbaijan, fruits have been used against fever (malaria) since ancient times.

Mespilus (*Mespilus* L.) is a genus of plants belonging to the family of the family of florets. There is enough information in the literature about the benefits of medlar, but there is very little information about its genomics. The fruits of help in the complex treatment of anemia, are diuretic, and regulate the activity of the immune system. Tea made from medlar fruits is a medicine for chronic cough. It has a positive effect against diseases such as asthma and bronchitis. As it has a strong antioxidant and astringent effect, it helps heal wounds in the mouth faster. As a completely natural source of healing, the seeds of medlar, like its fruit, are very useful for the digestive system. Infusing the seeds in water also increases urine output, helps dissolve kidney stones and reduce kidney cramps. The seeds of the fruit should be boiled and drunk as tea. Like all fruits, blueberries are best eaten fresh. For those who follow a diet, argyle seed tea is a very useful product. This tea ensures rapid burning of excess fat accumulated in the body. Medlar, which has irreplaceable qualities, can be used abundantly in its season to benefit from its endless benefits. Although the center of origin of Medlar is the South Caucasus, it is currently found in the European continent and Western Asia [5]. It is one of the tumescent plants widely distributed in Zagatala, Gabala, and Sheki in Azerbaijan [2].

Varieties and forms of local and introduced *Cornus* L. and *Mespilus* L. collected from Guba, Khachmaz, Gusar and Sheki regions of Azerbaijan, having a high degree of polymorphism, were used as the research object.

The main goal of the research work is to determine the areas of local and introduced varieties and wild forms of Cornaceae and azgil distributed in Guba, Khachmaz, Gusar and Sheki regions of Azerbaijan, to analyze their current status, to study their biomorphological characteristics, to identify them based on molecular markers, to determine the degree of genetic kinship, and to select based on them programs have been used effectively. Determination of biomorphological characteristics and economic indicators of the plant was carried out on the basis of "Program and method of sorting of fruit, berry and fruit crops" (1973) [3].

In order to realize this goal, the following issues have been put forward: detection and registration and varieties and wild forms common in individual farms, backyards, and mountain-forest areas with scientific expedition research in Guba, Khachmaz, Gusar and Sheki regions of Azerbaijan, GPS technology determination of areas by means of; Comparative study of biomorphological characteristics of genotypes, economic indicators, pomological analysis and evaluation of similarity according to quantitative indicators; Characterization of genetic diversity through microsatellite markers, calculation of polymorphism information volume; Determination of genetic relatedness and efficiency of the marker system among the studied samples using ISSR markers. In order to determine the genetic diversity and relatedness of the studied samples, DNA

was extracted using the CTAB protocol proposed by S. O. Rogers, PCR reaction was performed, and the obtained amplification products were electrophoretically analyzed in agarose gel [6].

The average value of the investigated biomorphological, pomological and biochemical parameters was used for statistical calculations. The relationships between the signs were investigated by principal component analysis (PCA). Statistical analyzes were performed in SPSS 16.0 and PAST statistical computer software. The standard deviation (SD), standard error (SE), minimum, maximum, average values and coefficient of variation (CV%) for the studied characteristics are given in Table 1. Among the signs, the highest coefficient of variation was determined in the mass of 20 fruits (1595%), and the lowest coefficient of variation was determined in the mass of the kernel (1%). One can mention the length of the leaf (178%) among the traits that showed a high coefficient of variation. Also, the maximum value of the mass of twenty fruits had the highest index (224).

Fruit length, width, stem length, fruit mass, Latin mass, pith length, pith width, sugar content and leaf parameters were also studied. The length of the fruit varied between 7.6-29.4 mm depending on the varieties. The highest indicator was observed in the common Cornaceae (Khachmaz) variety, and the lowest in the Crab Cornaceae (Gusar) form. The size of the width of the fruit was also different. Crab Gusar form had the lowest index of 11.3 mm, while Caucasian variety had the highest index of 28.6 mm.

Along with other parameters, the length of the fruit stalk was also studied. These sizes ranged from 30.2 to 63.3 mm, and the shortest stem was found in the Crab Gusar, and the longest in the Caucasian variety.

In the study, the average weight of one fruit varied from 1.01 to 11.2 g. Thus, the fruit with the smallest mass was observed in the form of Gusar, and the fruit with the highest mass was observed in the Caucasian berry variety.

In order to determine the quality of the studied varieties and forms, the percentage of total sugar in the juice was studied. The highest sugar content was found in the form of Common berry Khachmaz (26.9%), and the lowest in the Amber Crab berry variety (11.3%).

Table 1

ECONOMIC INDICATORS AND POMOLOGICAL ANALYSIS
 OF VARIETIES AND FORMS OF THE BERRY PLANT

<i>Characters</i>	<i>Abbreviation</i>	<i>Min</i>	<i>Max</i>	<i>Average</i>	<i>SX</i>	<i>SK</i>	<i>CV %</i>
length of the fruit	LF	8	29	22	0	4	16
width of the fruit	WF	7	29	21	1	4	19
length of the stem	SL	24	63	39	1	8	67
mass of the kernel	KM	0	1	1	1	0	1
latin mass	LM	1	25	24	0	3	9
Total sugar	TS	11	27	16	0	4	16
length of the core	LC	6	13	7	0	2	3
width of the core	WTC	6	10	4	0	1	2
mass of the fruit	MF	1	11	10	0	2	4
mass of twenty fruit	MTF	20	224	203	5	40	1595
Leaf stalk length	LSL	30	52	22	1	5	20
Leaf length	LL	64	122	58	2	13	178
Leaf width	LW	28	68	41	1	8	68

Thus, these research results can be used in the creation of new varieties that are more productive of good quality, have a good appearance, and meet the market demand.

ISSR is a fast, simple, highly reproducible method. ISSR markers usually show high polymorphism, and their biggest advantage is that no prior information about the genome sequence is required [4]. In the study of the genetic diversity of the cranberry genotype, a total of 68 points were synthesized on 8 ISSR primers characteristic for fruit plants, of which 47 (69.1%) were polymorphic, and 21 (30.9) were monomorphic. The number of amplified fragments per locus varied between 7-10. The length range of the obtained fragments was 100-1200 n. c. changed between

The largest number of amplicons (10 units) was synthesized with IS 50 and IS 54 primers. 8 amplicons synthesized with IS 50 primers were polymorphic. In the IS 54 primer, 5 of the synthesized points were polymorphic, and the other 5 were monomorphic. The lowest number of amplicons was recorded in primers IS 3 and IS 48 (7 amplicons). 4 of the amplicons in the IS 3 primer are polymorphic. Using the IS 48 primer, 5 of the synthetic compounds were polymorphic. The number of polymorphic items varied between 4-8, on average it was 5.9 items. The number of items per primer was 8.5.

Table 2

KEY PARAMETERS OF POLYMORPHISM AND GENETIC DIVERSITY DETERMINED
 IN BERRY GENOTYPES BY ISSR PRIMERS

Primers	Sequence (5-3)	Synthesized	Number of polymorphic clauses	Polymorphism, %	Rp	PIC	EMR	MI	MRp	GM
IS 2	(GA) ₉ C	9	6	70	5.56	0.33	6.75	2.2	0.02	0.96
IS 3	G(TG) ₉	7	4	57	7.46	0.41	4.1	1.6	0.02	0.85
IS 37	(CA) ₈ GT	8	6	75	5.00	0.33	5.6	1.7	0.03	0.94
IS 47	(ACC) ₆	8	5	62.5	6.30	0.41	5.6	2.3	0.02	0.91
IS 48	(ATG) ₈	7	5	71.4	5.16	0.43	4.2	1.7	0.03	0.93
IS 50	(GAA) ₆	10	8	80	7.34	0.45	8.0	3.6	0.01	0.97
IS 54	(AG) ₈ C	10	5	50	8.34	0.41	8.0	3.3	0.01	0.93
UBC 868	(GAA) ₆	9	8	89	4.46	0.32	6.8	2.0	0.03	0.89
Common	-	68	47							
Average price	-	8.5	5.9	69.4						0.92

As can be seen from Table 2, the polymorphism indicator for primers varied between 50-89%, the average polymorphism was 69.4%.

In another direction of the work, the antioxidant properties of medlar collected from Guba, Gusar, Sheki regions of Azerbaijan were studied. The dried fruits are crushed until they become a powder (the size of the particles is about 1 mm). Ethyl acetate stored at room temperature in the ratio of 1:20 is added to the obtained powder (20 ml of ethyl acetate per 1 g of powder). After one day of storage, it is filtered through a special paper filter. After filtration, the solution was evaporated at room temperature and the extract was dried to constant weight in a vacuum oven. In the model of cumene oxidation, the antioxidant properties of azgil extract were studied using the kinetic method. Oxidation experiments were carried out in a nanometric apparatus with automatic pressure control. The oxidation of cumene was monitored by the oxygen absorption method. Chlorobenzene was used as a solvent. In all experiments, the volume of the mixture was 5 ml, and the concentration of cumene was 2.87 mol/l. Experiments have shown that during the oxidation of

cumene, clearly defined induction periods are formed on the kinetic curves of oxygen absorption in the presence of the studied extracts. The formation of the induction period indicates the presence of antioxidant substances in the extracts. The detected induction periods were described by the equation $\tau = f \cdot [I n H]_0 V i$, which allowed to determine the effective content of antioxidant ($f \cdot [I n H]$) in modern fruit extracts. Here $[I n H]_0$ is the antioxidant content in a given sample of essential oil, $V i$ is the onset rate, f is the ginger factor. Thus, research has shown that ethyl acetate extracts of German gooseberries contain antioxidants and exhibit antioxidant activity. Moreover, the amount of antioxidant substances in the extracts of elderberries grown under natural conditions is slightly higher than that of cultivated elderberries.

A total of 68 points were synthesized for the ISSR primer, of which 47 (69.4%) were polymorphic, and 21 (30.9%) were monomorphic. The number of fragments amplified at the locus varied between 7-10.

Primer UBC 868 was found to be most effective as an ISSR for polymorphism and genetic diversity assessment in a collection of cranberry samples. In addition, studies conducted in other directions have shown that the amount of antioxidant substances in the extracts of elderberries grown under natural conditions is slightly higher than that of cultivated elderberries.

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