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POLYMORPHISM AND MORPHOLOGO-BIOLOGICAL FEATURES OF ABORIGINAL FORMS OF WALNUT (JUGLANS REGIA L.) IN PAMIRE

Research article

Abstract

In the given article there are multiyear researches about morphologo-biological parameters of fruits and contents of oil in the kernel of perspective shapes of walnut in Western Pamir's conditions.

Keywords: Shape, fruits of walnut, contents of oil in the kernel of walnut, aboriginal forms, Western Pamir.

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ПОЛИМОРФИЗМ И МОРФОЛОГОБИОЛОГИЧЕСКИЕ ОСОБЕННОСТИ АБОРИГЕННЫХ ФОРМ ОРЕХА ГРЕЦКОГО (JUGLANS REGIA L.) НА ПАМИРЕ

Научная статья

Аннотация

В статье приводятся результаты многолетних исследований о морфобиологических особенностях, о полиморфизме плодов ореха грецкого и содержание масла в ядрах орехов произрастающих в условиях Западного Памира.

Ключевые слова: формы, плоды ореха грецкого, содержание масла в ядрах ореха грецкого, аборигенные формы, Западный Памир.

1. Introduction

Walnut (*Juglans regia* L.) was described in 1753 by Linnaeus. At present, in different countries of the world, walnut is cultivated or grown in natural conditions on area of 176 thousand hectares in China, 80935 hectares in Mexico, 60 thousand hectares in Iran, 59 thousand hectares in Turkey and other countries. In Tajikistan, the walnut grows both in its natural form and widely is cultivated. In recent years, interest in walnut cultivation has grown significantly. The areas occupied by its culture or planting are increasing. This culture was bred except in the Eastern Pamir, in all regions of the Republic of Tajikistan and despite the shortage of land in our republic, its area is more than 8 thousand hectares [1,2,3,]. Many works on walnut culture are known in various regions of Tajikistan [2-5], however, in the conditions of the Western Pamirs, only a few scientific publications are devoted to studying the gene pool and polymorphism of this important culture [6,7]. A.B. Gursky [8] showed that in Badakhshan region of Tajikistan there was no cultivation of walnut before, therefore, there was no its selection. All the variety of forms of these plants, including the very valuable ones, which beat the highest world standards in nuclear output and fat content, is a product of nature, especially favorable climatic conditions.

2. Objects and methods of researching

The objects of researching were used the model trees from the families Juglandaceae - walnut (*Juglans regia* L.) in Vanj district of the Gorno-Badakhshan Autonomous Region (Western Pamir) of Tajikistan. The studies or testing were carried out in laboratory field, stationary and route-forwarding conditions.

The route-forwarding research methods, selection of the model trees, analysis of the technical quality of the fruit and determination of the productivity of promising forms of walnut trees were carried out according to the programs and methods [2, 8]. The oil content in walnut kernels was determined by the methods described by B.P. Pleshkov [9]. It should be noted that the oil content in the walnut kernels of the studied objects was determined in different years - in 1998-2000. [1] and 2013-2015.

3. Research results and their (its) discussion

The polymorphism of walnut fruit has so far been studied in narrow geographic areas [5]. The shape of the walnut fruit are in different kinds - rounded, elliptically-ovoid, elliptical, obovate, rectangular or other shapes. In the conditions of the Western Pamir, the walnut fruits are various in sizes too (Fig. 1).



Figure 1 – Polimorphism of fruit,s walnut (*Juglans regia* L.) in Western Pamir,s conditions

The results of our research (Table 1) show that there is no regular relationship.

Table 1 – Indicators of fruits of walnut at different altitudes in the Western Pamir

West pamir areas (at high altitudes)	Dimension of the nut fruit																	
	Thickness , mm			Lengthmm			width, mm			Weight, gr.			kernel of nut weight %			Oil of nut weight %		
	Min.	Mid	Max	Min.	Mid	Max	Min.	Mid	Max	Min.	Mid	Max	Min.	Mid	Max	Min.	Mid	Max
Vanj (1600-2500)	25,0	30,1	34,3	22	35,0	44,5	27,0	30,1	34,3	6,0	13,1	18,7	34,3	40,2	64,3	59,2	69,5	76,3
Rushan 1900-2500	24,3	30,0	32,1	24,1	37,1	43,2	25,1	28,9	38,0	5,9	12,6	17,8	30,1	40,0	55,1	55,6	60,7	73,1
Shugnan (2000-2300)	24,9	30,0	33,0	20,0	33,0	40,0	24,1	31,3	36,2	5,0	12,0	16,1	31,2	39,8	60,2	54,3	59,3	73,0

The dates in Table 2 show that the average weight of the perspective forms of walnut fruit in Western Pamir ranges from 6.0 to 17.3 g. According to the classification [8], 25% of the fruits are very small nuts (<8 g); 35% - to small-fruited (8.1-10 g); 30% - to the fruits of average size (10.1-12.0 g); 5% - to large-fruited (12.1-14.0 g) and 5% - to very large-fruited (> 14.1 g) [5]. The number of walnut fruit in 1 kg of sample varies from 58 to 168 pcs. An inverse relationship was found between the weight of fruits and their number in kilograms (table 2).

Table 2 – Morphobiological parameters of fruits of promising forms of walnut in Vanj region of Western Pamir

Sort (kind)	Number of nuts In 1 kg, pcs	Average weight of one nut	Nut parameters, mm			Characteristics of the nutshell surface	Separability of nut kernel point	Output or yield			Taste cores point
			height at Separate	diameter by the seam)	Diameter (on each side)			kernel g	kernel %	waste %	
Bunai standart	100	10.0	35.9	33.4	34.8	4	4	5.8	58.0	42.0	5
Bunai 1	100	10.0	40.0	33.7	31.8	3	3	5.1	51.0	49.0	4
Black nut	95	10.6	40.9	34.3	32.4	2	4	6.0	60.0	40.0	5
Bunai 4	100	10.0	40.1	33.0	31.5	4	3	5.27	52.7	47.3	5
Kurk nut	97	10.4	38.2	33.0	34.5	4	4	5.08	46.2	53.8	4
Bunai 6	93	10.8	35.8	30.0	30.0	3	4	5.12	47.0	53.0	5
Bunai 7	90	11.7	38.0	33.5	33.1	4	4	4.84	43.0	57.0	5
Hameli	115	8.8	36.0	31.2	32.1	4	3	3.81	50.0	50.0	4
Chikhokh-3	168	6.0	29.0	28.0	26.0	4	4	3.88	60.0	40.0	5
Chikhokh-4	145	7.0	32.0	32.0	31.5	4	4	4.20	64.0	36.0	5
Chikhokh-24	120	8.5	36.0	34.9	31.8	2	4	5.10	60.0	40.0	5
White nut	115	8.7	36.1	31.0	32.3	3	4	4.00	44.1	55.9	5
Tabacoo nut	80	12.5	39.0	34.1	33.5	4	4	5.12	53.0	47.0	5
Potov-10	58	17.3	39.4	35.0	36.8	3	3	7.00	53.0	47.0	5
Kapar nut	60	16.7	41.2	39.5	37.8	4	4	6.00	60.0	40.0	5
Savad 1	130	7.7	36.0	29.1	29.0	4	4	4.71	58.9	41.1	5
Bresher 1	79	12.7	40.1	30.7	31.9	3	2	5.30	43.0	57.0	5
Torsher 1	130	7.7	30.6	28.0	29.0	2	3	4.18	52.0	48/0	4
Torsher 2	110	9.1	31.8	32.0	33.6	4	4	5.60	56/0	44/0	5
Torsher 3	110	9.1	36.5	28.1	28.5	3	4	4.13	44.1	55.9	5

According to the classification of varieties according to the parameters of fruits according to a 5-point scale, the size of fruits in 30% of promising forms of walnut growing in the conditions of Western Pamir should be estimated at 4 points; 35% - by 3 points; 10% - by 2 points and 25% - by 1 point. The surface of the nutshell is smooth, slightly wrinkled, wrinkled and roughly wrinkled. Among the forms we have selected, the majority has an almost smooth shell surface (4 points), wrinkled - 15%, with a roughly wrinkled surface not found.

In technical analysis of the fruits of promising forms of walnut, an important indicator is the yield of the kernel. Forms of nuts by the exit or yield of the kernel are grouped and evaluated on a 5-point scale. We found that among the studied promising forms for further breeding in the conditions of the Western Pamir, 30% belong to the nut with a very high content of the kernel (> 56%), the fourth group includes 5%, that is, with a high content of the kernel (53.1-56 %)), 20% belong to the average (49-53%) and 20% - to the low (45-49%). With a very low content of the core make up 25% of the objects studied.

By separability, walnut varieties are grouped and rated on a 4-point scale [3], and more than half of the promising forms of walnut growing in the conditions of the Western Pamirs belong to the 4th group, that is, the kernel is separated very well. Nearly more than 80% of promising walnut forms have an excellent core flavor (5 points) (Table 1). A direct relationship has been revealed between the oil content and the taste of the kernel of walnut fruit. According to the currently existing ideas, the chemical composition of fruits is a reliable variety-distinctive sign, although there is some variation in this dependence on the growing conditions of varieties [1, 5, 6].

The results of our researching or testing (Table 3) show that the oil content in the walnut kernel, both in the conditions of the Western Pamir (Vanj district) and in other conditions [5], is different and depends not only on the shape diversity, but also on the individual characteristics, from the growing conditions of the tree and from climatic factors. Biochemical analysis showed that in different forms of walnut trees growing under the conditions of the Vanj district (Western Pamir), the share of oil in the kernel of the model trees ranges from 65.1 to 74.2%. A comparative analysis of different walnut forms under almost identical growing conditions and climatic factors in different years showed that the oil content in the kernels of different walnut forms is different.

From the indicators of long-term observations presented in Table 3, it follows that, regardless of the factors listed above, the oil content in the cores was: “Bunai” form - 19.4%, “Torscher-4” form - 6.3%, and “Torsher-1” form - 6.1%, the form “Sed-1” - 5.9%, the form “Brescher” - 2.7%, while the average value of the multi-year data of this indicator is 2.2%. It follows that the oil content in the walnut kernel, first of all, depends on the individual characteristics of this form.

Table 3 – Changing the oil content in the walnut kernel in the same model trees under the conditions of Vanj region of Western Pamir (1996–2000, 1, 2011–2015)

Conventional name of model trees (high oil)	Oil,% by weight of the core				
	1996	1997	1998	1999	2000
	2011	2012	2013	2014	2015
Bunai 1	70.5	62.9	69.2	62.5	71.8
	70.8	68.3	70.1	63.1	72.5
Sed	74.4	62.9	69.5	73.1	71.0
	73.9	68.3	73.6	70.6	71.5
Chihoh 2	70.5	75.0	70.2	71.4	71.5
	71.2	75.4	69.9	72.0	71.5
Chihoh 3	71.4	69.2	72.3	68.2	70.9
	70.5	70.5	72.1	69.1	70.9
Chihoh 4	72.5	68.0	69.2	69.0	72.6
	71.3	70.3	69.1	69.5	72.8
Brescher 1	72.0	68.0	70.3	68.3	71.4
	72.0	70.0	71.4	70.4	71.5
Torsher 1	71.5	69.4	68.2	69.2	74.2
	70.6	71.9	68.1	69.5	69.1
Torsher 2	74.2	70.1	71.0	70.5	71.3
	74.4	73.3	71.0	70.6	71.8
Torsher 4	71.3	65.2	65.0	66.1	69.4
	70.9	69.1	69.3	65.9	C70.5

Continuation of the Table 3

Torsher 6	71.4	64.0	65.0	64.5	70.1
	71.6	65.9	69.3	70.5	71.0
On average	71.9±0.56	68.1±1.5	68.9±0.75	68.2±1.75	70.9±0.69
	71.8±0.69	70.4±1.6	70.6±0.9	69.1±0.7	71.3±0.95
Annual precipitation, mm	203	215	208	210	205
	205	208	206	207	208
Average air temperature per year,	9.5	9.0	9.8	9.0	9.8
	9.7	9.8	9.5	9.5	10.2

*Note: 1 - data obtained by us earlier (1996-2000);

2 - Walnut forms are conventionally called the names of the villages where they grow

Thus, on the basis of the obtained data on the study of polymorphism of a walnut in Pamir conditions, it can be concluded that tree height, crown shape, crown diameter, leaf size and leaflets cannot serve as systematic signs for determining the type or form of this breed, then it should be noted that the shape of the walnut fruit, its surface and size, to a certain extent, can serve as a form of walnut trees.

The results of many years of research into the study of morphological, biological, and biochemical features of the object under investigation indicate that more than 10% of promising forms of walnut growing in the conditions of the Western Pamirs are large and very large, and 30% are very high core content. It is shown that the oil content in the walnut kernel depends not only on the shape diversity, the growing conditions of the tree, climatic factors, but also above all on the individual characteristics of the form.

Conflict of Interest

None declared.

Конфликт интересов

Не указан.

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