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Introduction, Breeding and Use of Persimmon Species (*Diospyros* spp.) in Ukraine

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Abstract

The first written documents mentioning the persimmon introduction to the Ukrainian territory, are dated in the year 1888. The first locally spread persimmon species evaluation was realized in the years 1924-1926 at the Research Institute in Suchumi. Since 1901 several research projects of the Nikita Botanical Garden in Krym have been focused on persimmon varieties characterisation, dealing with those introduced from China and Japan. Nowadays, most of the research, cultivation and breeding activities are fulfilled in the area of Crimea and Kyjev, especially in the Nikita Botanical Garden, Nova Kachovka Experimental Research Station and M. M. Grishko Botanical Garden in Kiev. There were successfully bred new accessions of *Diospyros kaki*. Young plants of *Diospyros virginiana* have been used for persimmon grafting. In spite of the high amount of persimmon trees growing in Ukraine most of them are not planted in orchards, but in private gardens.

INTRODUCTION

Persimmon introduction and expansion in Russian speaking countries took place earlier than in the rest of Europe (Bellini et al., 2003). The first seeds of Japanese persimmon were planted in the Nikita Botanical Garden in Yalta in 1819, but the plants of this attempt were not able to survive (Richter, 1970). Successful propagation of Japanese persimmon in the Botanical Garden started by the end of the 19th century by the cultivar 'Kostata', resistant against frost. Presently these trees are 95-130 years old, growing in the Crimean region (Pasenkov, 1961; Kazas and Lobov, 1996). In 1901 the seedlings from the collection of *Diospyros kaki* Thunb., imported from France, were planted in the Nikita Botanical Garden. The cultivar Kostata was an important base for the research, breeding and propagation in the Crimean region (Richter, 1970; Kazas and Lobov, 1996). In 1938 the collection was extended by introduction of other cultivars from different parts of the world (Pasenkov, 1970). The breeding experiments in the years 1945-1948, based on selection of individuals with larger fruits, resulted in the first original Ukrainian persimmon cultivars (Pasenkov, 1961). Until 1970 together 19 persimmon cultivars were bred in the Nikita Botanical Garden. In 1953 the researchers started the first experimental planting of Japanese persimmon (*Diospyros kaki*) in the areas of Odessa and Uzhgorod, although the majority of these trees did not survive and only around Uzhgorod some individuals grow until today (Kazas, 2007). In 1957 in the Cherson steppe area (with dry and climatically demanding conditions) near the town Nova Kachovka the Experimental Station "Novokachovskoye" has been established. Until 1966 approximately 60 Japanese persimmon cultivars had been tested and bred there (Kazas, 2007). Lastly in this activities was incorporated the team of the M.M. Grishko National Botanical Garden of the Ukrainian National Academy of Sciences in Kiev. They focus on persimmon introduction under the difficult climatic conditions of the Kiev area.

MATERIALS AND METHODS

The principal aim of this paper is to present knowledge on introduction, breeding, propagation, dissemination and use of persimmon in Ukraine conditions. The problems were solved by two approaches. In the first case, all available information was collected from Ukrainian literature resources, concerning the introduction, adaptation and breeding of persimmon in the territory of present Ukraine. For a better understanding of the current situation surveys on climatic characteristics, dealing with a study and conservation of persimmon genetic resources, were elaborated. For this reason data from well and less known literature sources as well as from archives were taken into account. In the frame of individual experiments several persimmon varieties preserved or bred on Ukraine territory were evaluated. The economic value of the group of domestic and foreign Japanese persimmon varieties (*D. kaki*), grown in the Experimental Station in Nova Kachovka and in Kiev, was assayed.

RESULTS AND DISCUSSION

The first persimmon introduction into the current Ukraine territory was done on Crimea in the Nikita Botanical Garden because of the very suitable climatic conditions in the region (Table 1). In this area the medium yearly value for temperature is 12.9°C, for precipitation 628 mm and for air humidity 69% (Table 1). Nowadays, persimmons collecting continues, with the focus on new genetic resources (*Diospyros* spp.). Together 186 cultivars have being searched there.

Testing, growing, breeding and spreading of persimmon in the steppe area of Ukraine is reasoned by the needs of adaptation of new species on difficult climatic conditions, what is secured by the team of the Experimental Station “Novokachovskoje”. There are specific extreme temperatures during a year – very low in the winter and relatively high in summer (Table 1). Moreover, the precipitation is quite low, the steppe area is governed by exceeding dryness (Table 2). Successful growing of persimmon in this area is enabled by a high level of underground water and exploitation of irrigation.

When the first persimmon genotypes were introduced and adapted to new agro-ecological conditions in Ukraine, an intensive breeding program in the Nikita Botanical Garden started. In the first stage hybrid populations grown from seeds were used for selection of new cultivars. It is proved by the varieties gained by selection from seedlings registered in 1945 and followingly in 1948 (‘Sputnik’, ‘Krymchanka’, ‘Prelestnaya’, ‘Nikitskiy prevosходnyj’, ‘Nikitskaya’ and ‘Izobilnayav’). The first bred cultivar based on intra-species hybridization was ‘Zolotaya osen’ (Table 2). To important achievements of breeders could be counted the ‘Virginskaya’ cultivar based on inter-species hybridization of *D. virginiana* × *D. kaki*, registered in 1948. Based on the same hybridization has been bred the world-wide known ‘Rossiyanka’ cultivar followed 10 years later by the ‘Nikitska bordova’ cultivar (Table 2).

The first bred group consisted of varieties with small fruits (Table 3). Bigger fruits were produced by ‘Mechta’, ‘Zolotaya osen’, ‘Zamanchiviy’, ‘Yaltinskiy’, ‘Zarya’, ‘Zorka’, ‘Konkurent’ and others (Table 3). At the end of the 20th Century in Ukraine were bred a group of varieties of ‘Mount Rogers’, ‘Mount Goverla’ and ‘Mount Roman-Kosh’ with larger fruits, as is documented by an experimental study of traits and their comparison with older varieties (Table 4). They are disseminated and grown mostly in private allotments and small orchards in the south of Ukraine.

The agro-ecological environment is affecting several traits of *D. kaki* and *D. virginiana* fruits as documented by results of experimental study in areas of Nova Kachovka and Kiev (Tables 4, 5). The results confirmed the unsuitability of Kiev conditions for persimmon growing (Table 5). The Japanese persimmon in this region is perishing through frost. Although its regeneration ability is quite high, the tree is not flowering and the fruit is not produced. To be preserved in nature, it should be protected during winter time. The Kiev team is testing the inter-species hybrids from crossing *D. kaki* × *D. virginiana* using the varieties ‘Nikitska bordova’ and ‘Rossiyanka’.

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Tables

Table 1. Climatic characteristics of experimental workplaces on persimmon.

Climatic indicators / Workplaces	Kiev ¹	Nova Kachovka ²	Yalta ³
Medium temperature in year (°C)	7.7	9.8	12.9
Minimum temperature in winter (°C)	-32.9-1950	-32.2-1911	-32.2-1911
Maximum temperature in summer (°C)	39.4-1936	44.0-2007	39.6-1998
Medium precipitation in year (mm)	650	441	628
Lowest yearly medium precipitation (mm)	358-1862	174-1921	309-1934
Highest yearly medium precipitation (mm)	1000-1933	627-1977	1118-1981
Maximum daily precipitation (mm)	103-1902	86-1956	189-1968
Medium air humidity (%)	75	74	69
Medium number of days in year with precipitation	157	115	114

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Table 2. Survey of persimmon bred varieties (*Diospyros* spp.) in Nikita Botanical Garden up to the year 1970.

Cultivar	Year of breeding	Origin of cultivar
Constant varieties		
1. Nikitskaya	1948	Seedling of <i>D. kaki</i> species
2. Izobilnaya	1948	Seedling of <i>D. kaki</i> species
3. Virginskaya	1948	<i>D. virginiana</i> × <i>D. kaki</i> × <i>D. lotus</i>
4. Zolotaya osen	1948	Batumskiy 1 × Schagotsu-Gaki
5. Zamanchiviy	1950	Seedling Fuyu cultivar
6. Pribreznaya	1950	Kuro Kuma × Fuyu
7. Rossiyanka	1959	<i>D. virginiana</i> × <i>D. kaki</i>
8. Mechta 459	1954	Kuro Kuma × Fuyu
9. Zamanchiviy	1950	Seedling of Fuyu cultivar
Changeable varieties		
10. Sputnik	1945	Seedling of <i>D. kaki</i> species
11. Zarija	1948	Seedling of Batumskiy II cultivar
12. Cyganochka	1950	Kuro Kuro × Fuyu
13. Tavrichanka	1950	Kuro Kuro × Fuyu
14. Zvezdochka	1950	Batumskiy II × Fuyu
15. Rubinova	1950	Kuro Kuro × Fuyu
16. Ukrajinka	1952	Seedling of Tseru-no-ko cultivar
17. Hybrid F 1648	1961	<i>D. kaki</i> × <i>D. virginiana</i> L

Table 3. Fruit traits comparison of persimmon (*Diospyros* spp.) varieties bred in Nikita Botanical Garden up to 1970.

Cultivar	Weight (g)	Height (mm)	Medium (mm)
Pribrezhnaya 462	27.5 - 95.4	30.0 - 51.0	40.0 - 59.7
Rossiyanka 18	47.0 - 60.0	31.8 - 33.0	47.2 - 48.0
Mechta 459	44.3 - 187.0	40.0 - 57.8	41.6 - 74.5
Zolotaya osen 583	85.0 - 194.0	55.2 - 72.7	52.9 - 71.1
Seyanec Khachiya 117	40.0 - 74.6	35.4 - 23.9	34.0 - 65.0
Zamanchiviy 636	115.0 - 268.0	54.0 - 85.7	63.0 - 86.7
Nikitskaya 242	34.7 - 105.0	30.0 - 41.9	44.0 - 65.0
Izobilnaya 243	32.2 - 129.0	34.6 - 50.9	40.7 - 68.0
Yaltinskiy 244	58.6 - 193.0	32.0 - 60.0	42.5 - 75.6
Ukrainka	38.0 - 100.0	47.0 - 55.0	40.5 - 54.7
Sputnik	38.5 - 102.0	29.7 - 57.2	38.0 - 61.3
Zarya 181	153.0 - 200.0	49.0 - 61.0	71.0 - 88.7
Zor'ka 187	55.6 - 190.0	51.2 - 56.4	68.8 - 75.4
Shokoladnaya 326	45.0 - 135.0	33.8 - 58.2	44.5 - 65.4
Doch Saburozy 321	35.0 - 83.8	41.3 - 54.0	45.9 - 58.0
Konkurent 110	64.3 - 278.0	47.0 - 67.9	43.0 - 73.6
Opylitel 48	55.0 - 150.0	42.6 - 54.2	55.0 - 67.0
Rubinovaya 461	94.0 - 115.0	39.8 - 47.9	61.7 - 67.9
Cyganochka 454	112.0 - 125.0	45.1 - 51.4	64.5 - 65.4
Tavrichanka 458	57.2 - 26.0	30.0 - 51.3	47.4 - 69.2
Zvezdochka 455	64.0 - 117.0	39.3 - 51.2	52.4 - 62.7
Opylitel 87	48.0 - 63.0	30.0 - 39.0	40.0 - 45.9
Yuzhnoberezhnyja 248	39.0 - 50.0	33.3 - 43.8	41.4 - 46.7
Urozhaynaya 85	35.0 - 73.2	33.9 - 48.4	41.5 - 63.6
Krymchanka 55	49.3 - 130.0	31.0 - 51.0	50.0 - 69.0
Makhodka	79.0 - 142.0	61.0 - 66.0	62.0 - 67.0
Prelestnaya 58	81.0 - 106.3	41.8 - 46.0	58.0 - 68.0
Krymskaya 98	41.0 - 125.0	25.0 - 30.0	30.0 - 49.0
Nikitskiy Prevoskhodniy	46.2 - 91.0	35.4 - 47.9	48.4 - 56.4

Table 4. Fruit traits comparison of persimmon (*Diospyros* spp.) varieties bred at the Experimental Station “Novokachovskoje”.

Cultivar	n	min.	max.	x	v (%)
Medium fruit weight (g)					
Rossiyanka	30	43.9	69.3	60.3	13.2
Nikitskaya bordovaya	30	61.3	97.7	76.9	16.0
Mount Rogers	30	103.6	141.4	127.3	11.5
Mount Goverla	30	138.4	151.3	144.8	2.8
Mount Roman-Kosh	30	89.1	134.1	109.5	16.3
John Rick (<i>D. virginiana</i> L.)	30	18.0	35.1	26.4	19.5
Meader (<i>D. virginiana</i> L.)	30	25.8	41.1	33.1	17.1
Veber (<i>D. virginiana</i> L.)	30	9.4	27.5	19.7	27.0
Medium fruit height (mm)					
Rossiyanka	30	33.1	40.43	37.3	4.9
Nikitskaya bordovaya	30	36.6	47.2	42.4	6.9
Mount Rogers	30	47.2	53.6	50.6	3.9
Mount Goverla	30	53.4	58.3	55.9	2.9
Mount Roman-Kosh	30	45.4	54.4	49.1	6.2
John Rick (<i>D. virginiana</i> L.)	30	24.9	34.4	29.5	7.7
Meader (<i>D. virginiana</i> L.)	30	28.8	33.3	31.3	5.5
Veber (<i>D. virginiana</i> L.)	30	19.0	31.7	27.1	11.7
Medium fruit width (mm)					
Rossiyanka	30	42.9	53.6	50.3	6.9
Nikitskaya bordovaya	30	48.4	69.7	54.4	10.3
Mount Rogers	30	58.4	71.7	65.1	6.6
Mount Goverla	30	66.6	73.8	69.1	2.9
Mount Roman-Kosh	30	55.6	67.8	62.0	7.7
John Rick (<i>D. virginiana</i> L.)	30	28.9	43.7	37.7	9.5
Meader (<i>D. virginiana</i> L.)	30	37.5	44.0	41.1	6.2
Veber (<i>D. virginiana</i> L.)	30	26.7	38.2	33.3	10.4

Table 5. Fruit traits comparison of persimmon (*Diospyros* spp.) varieties bred at the Botanical Garden in Kiev.

Varieties	n	min.	max.	x	v (%)
Medium fruit weight (g)					
Rossijanka	30	43.3	65.0	49.9	11.4
Nikitskaja bordovaja	30	51.8	98.3	75.2	17.5
John Rick (<i>D. virginiana</i> L.)	30	16.4	35.1	23.0	24.4
Meader (<i>D. virginiana</i> L.)	30	11.4	42.9	24.1	41.2
Veber (<i>D. virginiana</i> L.)	30	9.7	26.3	17.2	24.6
Medium fruit height (mm)					
Rossijanka	30	30.7	39.0	35.6	5.5
Nikitskaja bordovaja	30	35.5	46.1	40.9	8.8
John Rick (<i>D. virginiana</i> L.)	30	25.0	35.1	28.8	8.4
Meader (<i>D. virginiana</i> L.)	30	20.9	34.1	27.0	13.3
Veber (<i>D. virginiana</i> L.)	30	12.9	31.2	25.3	14.4
Medium fruit width (mm)					
Rossijanka	30	43.8	51.9	46.9	5.14
Nikitskaja bordovaja	30	48.0	68.0	54.7	10.9
John Rick (<i>D. virginiana</i> L.)	30	26.1	40.9	35.8	9.9
Meader (<i>D. virginiana</i> L.)	30	27.8	44.8	35.6	5.5
Veber (<i>D. virginiana</i> L.)	30	26.0	37.4	32.4	9.0