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INTERSPECIFIC HYBRIDS OF VINES (*VITIS VINIFERA* L. x *MUSCADINIA ROTUNDIFOLIA* MICHX.) WITH INCREASED RESISTANCE TO BIOTIC AND ABIOTIC FACTORS

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Abstract

Because of the climate change, the process of desertification intensifies. Grow requirements to the genetic resources needed to improve the cultures valuable increased resistance to biotic and abiotic factors. Feels a need to ensure the heightened autochthonous products necessities for the industrial branches of the national economy. The flowering plants adapts to the environmental conditions using various methods and the changes morfo-anatomic hold a decisive role under conditions the high environmental temperatures. The changes for adaptation of the plants can be studied on the basis of morphological and anatomical characters of the leaf, because this plant is the organ of plastic and responsive to changes in the environment. Ecological adaptation of the plants of the environment conditions of the hydric of the variability is realized based morphology and anatomy quantitative indicators leaf. So far they have created many varieties of vines, and yet has not acquired perfect of vines the variety, that has meet the maximum agro biological and technological properties. The achievements are well known in the selection of grapevine varieties resulted in obtaining high quality and resistance to biotic and abiotic factors, such as those from France, Italy, Germany, Bulgaria, Hungary, Romania, Moldova, Ukraine etc. but it should be noted that cultivation of the variety of vines requires mandatory the grafting their the rootstock north American (resistant to phylloxera), which greatly increases the cost of planting material production and the creation of plantations of vines.

Key words: *adaptation, anatomy, inter-specific hybrids, leaf, root, vines*

INTRODUCTION

For thousands of years the grapevine was included in the breeding process, so nowadays have come to be known approximately 12 000 species / varieties. However, so far failed to creating of the variety "ideal" that brings together the most valuable features of different varieties. Thus, the current the problem of obtaining new varieties of vines, characters agro-biological to satisfy the maximum requirements to the table grapes intended for fresh consumption, and towards those intended for industrial processing (juices, concentrates, wines, spirits).

The development of viticulture until the XIX century and is distinguished by creating varieties of vines varieties, such as: *Rara Neagră, Coarna Neagră, Bătuta Neagră, Frăncuşa, Feteasca Albă, Feteasca Neagră, Feteasca Regală, Galbena, Plăvaie, Grasă, Zghiharda* etc. These varieties were grown on their own roots and planting material was multiplied by the method of cuttings.

In the second half of the XIXth century (1863), European viticulture is subject to a radical turnaround in the cultivation of the vine conditional upon: *Phylloxera vastatrix / Daktulosphaira vitifoliae* (Fitch 1855); *Plasmopara viticola* (Berk. & M.A. Curtis) Berl. & De Toni, (1888); *Oidium sp.; / Uncinula necator* (Schwein.) Burrill. The methods of direct fight against the invasion of phylloxera, they have not led to the expected results. Resolve the situation in viticulture, at the time, it was only possible by introducing hybrids of direct producer vines (Seibel 1, Seibel 1000, Teras-20, Floot d'Or, Baco, Couderc, Rayon d'Or, etc.) and varieties of grafted vines. Thus grafting of grapevine was implemented everywhere because there is no other solution.

Achievements are well known in the selection grapevine resulted in obtaining new varieties of high quality and resistance to biotic and abiotic factors, such as the: France (Chardonnay, Cabernet Sauvignon, Pinot Noir, Merlot, Muscat Ottonel etc.), Italy (Fleurtai, Soreli, Early Sauvignon; Petit Sauvignon, Sauvignon d´ore; Petit Cabernet, Royal Cabernet, Royal Merlot, Petit Merlot, Julius etc), Germany (Soliaris, Hibernal-GM etc.), Bulgaria (Pleven, Bulgaria, Mavrud, Melnik, Pamid etc.), Hungary (Bianca, Valentin, Vinitor, Gloria, Zenit, Ijaki, Chincem etc.), Romania (Napoca, Victoria, Brumăriu, Transilvania, Someşan, Splendid, Ozana, Paula, Gelu, Raluca, Arcaş, etc.), Moldova (Viorica, Legenda, Reton, Luminiţa, Alb de Ialoveni, Negru de Ialoveni; Apiren alb, Apiren roz, Negru de Grozeşti, Kiş-miş moldovenesc, Kiş-miş lucistâi; Moldova, Guzun, Suruceni alb, Leana, Ialoveni rezistent, Codreanca, Tudor etc.), Ukraine (Arkadia, Vostok, Gherkules, Dnestrovchii rozovîi, Zolotistîi ustoicivîi, Kiş-miş tairovschii, Muscat jemciujnîi, Muscat tairovschii; Aromatnîi, Golubok, Iliciovschii rannii, Muscat odesschii, Odesschii Ciornîi, Ovidiopolschii, Rubin tairovschii, Suholimanschii belîi etc.) etc. It is should be noted that the cultivation of all varieties of the vine grafting plants in requires mandatory their North American rootstock (resistant to phylloxera), which greatly increases the cost of planting material production and the creation of of vines plantations.

MATERIALS AND METHODS

Interspecific hybrids of vines *Vitis vinifera* L. x *Muscadinia rotundufolia* Michx. they were involved in that study. For determine the resistance to drought of the vine express method was applied based on morphological and anatomical characters of the leaf lamina, consisting of: leaf lamina thickness, the average area of the leaf lamina, the average volume of leaf lamina, the report the average area of leaf lamina leaf lamina average volume [8, 9, 10]

Winter hardiness of interspecific hybrids to the (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) determined based on the buds the shoots a year.

Filloxera strength of interspecific hybrids to the (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) Was determined based on the anatomy of the roots [6, 7, 9, 11, 13].

RESULTS AND DISCUSSIONS

As a result of studying the quantitative anatomy of lamina leaf the grapevine (Vitis L.) were revealed morphological and anatomical four characters, which causes greater relative resistance to drought, namely: lower mean surface leaf lamina; the average thickness greater leaf lamina; greater average volume of leaf lamina; lower ratio of average area of leaf lamina leaf lamina average volume (S:V).

Inter-specific hybrids leaf lamina the thickness of vines BC3 hybrid it is 312.01 μm DRX-M4-508 and 299.54 μm DRX-M4-583 [1, 2, 3, 4, 7, 11, 19].

Table 1. Characters biometric hybrids of the leaf lamina interspecific hybrids of vines (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.)

Hybrid	Average surface of the leaf lamina (cm^2)	The average volume of leaf lamina (cm^3)	The report the average surface: the average volume of leaf lamina (S:V)	The average thickness of the leaf lamina (μm)
DRX-M_4-508	102.05	3.1841	32.05	312.01
DRX-M_4-583	72.36	2.1438	33.75	299.54
DRX-M_4-677	107.83	2.7087	39.80	251.20
DRX-M_4-547	70.36	1.7329	40.60	246.29
DRX-55	62.80	1.5464	40.61	246.24
DRX-M_4-542	88.81	2.1785	40.76	230.03
DRX-M_4-660	101.76	2.3982	42.43	236.90
DRX-M_4-545	95.56	2.2180	43.08	232.11
DRX-M_4-560	84.03	1.8926	44.39	225.23

The average surface lower lamina leaf of vines hybrids within the limits of 70.36 cm^2 hybrid DRX-M4-547 and 72.36 cm2 hybrid DRX-M4-583.

The average volume greater of leaf lamina hybrids of vines is within 3.18741 cm^3 hybrid DRX-M4-508 and M4-677 2.70873 hybrid-DRX.

Lower ratio of average area of leaf lamina the average volume of leaf lamina of the hybrids of vines has been found to be limited by 32.05, hybrid DRX-M4-508, and 33.75, hybrid DRX-M4 -583.

If the ratio S : V is lower, the relative to drought resistance is higher, so hybrid DRX-55 has the highest resistance to drought. At other study found that hybrids and they have a rather high resistance to drought: DRX-M4-660; - 677; - 560; - 508; - 583 (Tab. No. 1.).

Table 2. Winter hardiness of interspecific hybrids to the (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) determined based on the buds the shoots a year.

Hybrid	Buds examine, (unit.)	Buds vivid, (unit.)	The percentage of vivid buds, (%)	Buds dead, (unit.)	The percentage of dead buds, (unit.)	The level the resistance
DRX-M4-502	31	30	96.78	1	3.22	1
DRX-M4-537	21	20	95.24	1	4.76	1
DRX-M4-538	65	59	90.77	6	9.23	1
DRX-M4-545	41	39	95.13	2	4.87	1
DRX-M4-578	39	36	92.31	3	7.69	1
DRX-55	42	33	78.58	9	21.42	2
DRX-M4-504	8	7	87.50	1	12.50	2
DRX-M4-510	49	39	79.60	10	20.41	2
DRX-M4-535	82	71	86.59	11	13.41	2
DRX-M4-541	64	55	85.94	9	14.06	2
DRX-M4-579	35	31	88.57	4	11.43	2
DRX-M4-580	104	88	84.62	16	15.38	2
DRX-M3-3-1	14	10	71.43	4	28.57	3
DRX-M4-508	34	24	70.59	10	29.41	3
DRX-M4-512	14	10	71.43	4	28.57	3
DRX-M4-602	28	18	64.29	10	35.71	3
DRX-M4-660	11	7	63.64	4	36.36	3
DRX-M4-511	30	17	56.67	13	43.33	4

Winter hardiness of these hybrids is within into 4 groups depending on the percentage of each hybrid vivid buds. The hybrids from the group I winter hardiness have the highest percentage of vivid buds. To this group belong hybrids DRX-M4-502 (96.78% of buds vii), DRX-M4-537 (95.24%), DRX-M4-545 (95.13%), DRX-M4-578 (92.31%) (Tab. No. 2.).

The first attempts on studying of resistance grapevine to the phylloxera were initiated in France by the Ravaz (1909) and shall draw up a scale for determining the resistance grapevine to the phylloxera building on comparing the level of infection and degradation of species of the vine. Assuming that the resistant American grapevines (*Muscadinia rotundifolia* Michx.) and non-resistant grapevines culture (*Vitis vinifera* L.).

Millardet A. has tried to determine the relationship between anatomical structure of roots and resistance to phylloxera. It was found that the resistance to grapevine of the phylloxera root anatomical structure has a fairly compact cells are small in size and nodule formation occurs when the periderm fissure cicatrisation.

Prince I., based on three cases the studies determined of attack of phylloxera:

1. The phylloxera poking roots, and leaves, over a short period of time leaves the place, as a result, forming a point necrotic dead cell and consisting of the oxidized phenolic substances (ex.: *Muscadinia rotundifolia* Michx., *Vitis cinerea* Arnold.).
2. The phylloxera, the young leaves, make the creation of galas of different sizes, but the roots formed nodules and tuberose (ex.: *V.riparia, V.rupestri, V.berlandieri* etc.).
3. The phylloxera, the young leaves and the leaves the do not form galas puncture site, the result forming necrotic points. Instead, the phylloxera root and grows very intense and tuberose forming nodules of varying size (ex.: *V.vinifera L. V.amurensis* and *V.labrusca*).

Has been demonstrated that to the grapevines resistant to the phylloxera increased when injected by the phylloxera substances forming galas (amylase, protease, etc.) occurs redox process using phenolic substances present in tissue cells , the surrounding cells perish, and not training takes place galas. Phenolic substances in this case have the function of inactivating substances (inhibitors) [8, 17].

Golodriga I. studying the physiological and biochemical characteristics, morphology and anatomy of grapevine phylloxera-resistant and pathogenic microlfora have determined that parenchymal tissues of roots have smaller cells, located most compact between them. In the roots of the secondary structure is present phloem [12, 14].

The forms of phylloxera-resistant vines have the property of forming genotypic wound periderm. Wound periderm is an obstacle to the spread of pathogenic microflora.

The not resist at phylloxera vines and rotting wound periderm only partially insulates part the healthy root affected.

Nedov P. Guler A. in the dependence studying anatomical the correlation between quantitative indices of the vine roots with secondary anatomical structure and species and varieties resistance to phylloxera vines and pathogenic microflora, concluded that the wound periderm forms the roots of varieties and species resistant to phylloxera vines and rotting; phylloxera varieties responsive to wound periderm poorly formed or not formed at all.

By studying the characters physicochemical and morphological and anatomical resistance grapevine against phylloxera and pathogenic microflora it is concluded that vines with increased resistance to phylloxera has parenchymal tissues of the root composed of smaller cells located most compact between them . Phloem have secondary roots.

The phylloxera-resistant grapevines has the property to shape wound periderm, which has bactericidal properties and stop the spread of pathogens.

The plants attacked by the phylloxera initiates the process by creating self-defense wound periderm. The formation process of wound periderm of different species is resistant to the phylloxera is well developed and is not resistant to the undeveloped.

The vines resistant to the phylloxera periderm wound develop well as a result of the attack of the insect, that the response of the organism is formed periderm wound, which insulates by small tuberosities pathogens, thus stopping the spread of pathogens that lead to the root decay. In the cells in these tissues is increasing the synthesis of nucleic acids, proteins and starch.

The not resist at the phylloxera vines, wound periderm grows weak and insulates areas only partially damaged by the healthy and is not able to halt the spread of pathogens [13, 15, 16].

Given the physiological particularity of the insects was found that autotrophic to the sterol is an important particularity in the nutrition of insects. A plant tissue is the only source of sterols for phytophagous insects.

Based on the analysis of correlation and dispersion was found that the species of less resistant of vines of the leaves the tissues contain β-sitosterol more and less cholesterol in comparison with resistant species to phylloxera.

The species of vines resistant to by phylloxera contain in the tissues of β-sitosterol 73-82% the total quantity of the sterol and 12-14% cholesterol and the species susceptible to phylloxera contain 89-99% of β-sitosterol and 1.5-4.0 % cholesterol [15, 16].

According to some studies has been found that using of physiologically active substances with the function of stimulation growth of plants, as gibberellins, crezacin, mival, auxin etc. can influence of on the development process of phylloxera, especially on the ability of the pest propagation. This is due to changes in plant the biochemical processes under the influence of the physiologically active, inhibiting the ability of propagation of phylloxera.

The studies undertaken by the researchers Askerov Uh, Kazahmedov R. in Dagestan have demonstrated that using the physiologically active substances have reduced capacity by 50% propagating phylloxera [5].

The grapevines phylloxera-resistant forming of wound periderm, which has bactericidal properties and stop the process of spread of the pathogens.

Table 3. The thickness of the first periderm root of vineyards inter-specific hybrids to the (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.)

Hybrids	The thickness of the first root periderm (µm)	The number of cell layers of the periderm	The length of the cells (µm)	The width of the cell (µm)
DRX-55	105-116	9-12	12-20	6-9
DRX-M3-3-1	90-103	9-10	10-16	6-9
DRX-M4-508	83-105	8-10	10-12	7-9
DRX-M4-537	80-90	8-9	18-24	6-11
DRX-M4-541	80-95	8-9	9-18	6-10
DRX-M5-4-6	93-124	10-12	9-18	6-10

The thickness of the first root periderm on interspecific hybrid of vineyards studied varies from 80 µm to 124 mm, and be composed of 8-12 rows of compact the cells located next to each other (Tab. No. 3.).

The first root periderm tissue of the interspecific hybrids to the are formed in the layer of cells situated below the rizoderm. The layer of the felem (cork) of the first periderm be composed of 8-10 of cells rows tangential of radial elongated, compact located between them. The length of these the cells varies from 30 µm to 45 mm, and their width varies between 8 - 12.5 µm. Felem tissue thickness varies from 75 µm to 93 µm. The next layer of tissue felem, if formed in the same year, developing from the deepest layers of the root bark. The 2nd layer of the film is located below the tissue layer brown crust with a thickness of 93 - 110 µm. The total thickness of this layer of dead tissue, consisting of two layers of tissue felem the outside and inside and a layer of bark, between two layers of tissue felem, thickness 170-180 mm, and protects the roots of phylloxera action and other pathogens.

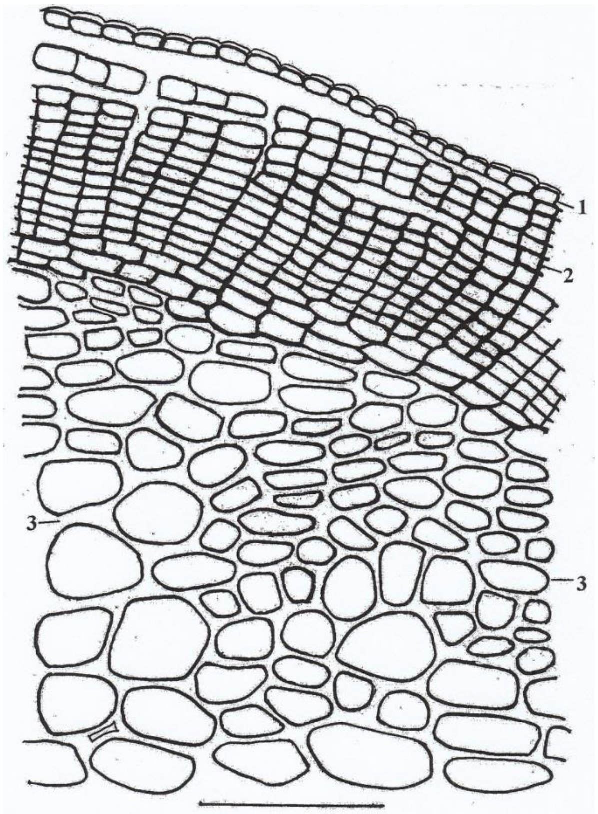

Fig. 1. The cross section through a sector of the root with the secondary anatomical structure (DRX-M4-508, 1 - epidermis; 2 - felem of the periderm; 3 - root bark)

CONCLUSIONS

As a result of interbreeding culture grapevine (*Vitis vinifera* L.), 2n = 38, with American grapevines (*Muscadinia rotundifolia* Michx.), 2n = 40 interspecific hybrids were created with diploid set of chromosomes 2n = 38.

Interspecific hybrids of vines (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) can be multiplied by cuttings and grown on their own roots, which would allow reducing some stages and finance expense in the production process of planting material and cultivation of the vine.

Interspecific hybrids resistance to phylloxera of vines (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.) is assured of first root periderm consists of the cell layer located under rizoderm, and increased concentrations of such chemicals, as phenols, resveratrolii etc.

Improving grapevine is resulting in the expected results just in case the inter-specific hybridization method of use based on initial taxons complementary to the various eco-geographical groups, creating indigenous of vines varieties. In this case a combined genotype of the desired characteristics and properties of the parent forms. The formation takes place of adaptation genotypic properties. An obvious expression of the adaptation of varieties created, it is possible only in case to obtain them in different species interbreeding result (taxons) of vines. Although it possessing resistance to the disease and pests, they also holds an advanced adaptation to the climatic conditions, thus accentuating the process of cultivation.

The new varieties of vines must possess a period precocious maturation of the grapes to ensure the planting and their cultivation and northern borders of the areas where they are viticulture and to ensure at the same time the mechanization and automation to the maximum possible agro-technical processes.

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