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БИОЛОГИЧЕСКИЕ И ЦИТОЛОГИЧЕСКИЕ ОСОБЕННОСТИ ГИБРИДОВ *VITIS VINIFERA* L. × *VITIS ROTUNDIFOLIA* MICHX

В данной работе приводятся результаты биологических и цитологических исследований зарубежных и местных гибридов винограда, уровень фертильности и их устойчивости (*Vitis vinifera* L. × *V. rotundifolia* Michx.).

Ключевые слова: виноград; диплоид; гибриды; хромосомы; фертильность.

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BIOLOGICAL AND CYTOLOGIC FEATURES OF HYBRIDS *VITIS VINIFERA* L. × *VITIS ROTUNDIFOLIA* MICHX

In this work the results of biological and cytological research, fertility and biotic stress resistance of the hybrids are given (*Vitis vinifera* L. × *V. rotundifolia* Michx.).

Keywords: grapevine; diploid; hybrids; chromosomes; fertility.

Cultivated and wild grapevines belong to the genus *Vitis* L. in the family *Vitaceae*. The genus *Vitis* contains two subgenera: *Euvitis* Planch. (bunch grapes) and *Muscadinia* Planch. (muscadine grapes).

Vitis vinifera in the subgenus *Euvitis* Planch. originated around the Mediterranean Basin and The Middle East. It is considered the predominant grape species grown world wide for fresh or for processed fruits. The

desirable quality traits include thin and tender skin, meaty pulp, large berries, high yield of clear juice, high sugar, content low ph, mild or subdued flavour.

Vitis rotundifolia Michx. in the subgenus *Muscadinia* are native to the south-eastern United States and was the first muscadine grape species to be cultivated. The natural range of *V. rotundifolia* extends from Delaware to central Florida and along the Gulf of Mexi-

co to eastern Texas (Munson, 1909; Dearing, 1938; Weaver, 1976). Temperatures in this region seldom go lower than – 12°C (U.S. Dept of agriculture, 1973).

Muscadinia grapes are distinguished essentially from the *Euvitis* species genetically, anatomically, physiologically and in taste that they should be considered a separate fruit. The major problem for gaining wider acceptance of muscadine grapes is its relatively low



fruits qualities compared to the excellent fruit of *V. vinifera*, but they are characterised by high diseases and pest resistance among *Vitis* species.

The American muscadine grapes have 40 somatic chromosomes ($2x=2n=40$) and are characterized by fruit borne in many cluster, formation of an abscission zone between the fruit and rachis, smooth thin bark that is adherent on young wood and separates in scales from older wood, unbranched tendrils, dense wood, and continuous pith.

In contrast, *Euvitis* grapes have 38 somatic chromosomes ($2x=2n=38$), branched tendrils, many berries per fruit cluster, no abscission zone between the berry and rachis, striated bark that peels in strips on old wood, less-dense wood than *Muscadinia*, and pith interrupted by diaphragms at nodes.

A long standing goal of both *Euvitis* and *Muscadinia* breeding programs has been development of hybrids between these groups, combining fruit quality from *V. vinifera* with disease resistance and environmental adaptation of muscadines.

The works on synthesis of new genome of grapevine has initiated by Wylie (1871). He pollinated two *V. vinifera* varieties with pollen of a male muscadine. Seedlings derived were highly sterile and considered true hybrids. Hybrids *muscadinia-euvitis* were later reports by Millardet (1901), Munson (1909) and Dearing (1917). The most extensive controlled crosses between the two subgenera were made by Detjen. The hybrid obtained from the female muscadine pollinated with bunch grape pollen were later proven to be straight muscadine derivatives (Detjen, 1919). Hybrids from *Muscadinia* and *Euvitis* crosses were successfully produced by Dunstan (1964) in North Carolina, Olmo (1971, 1986) at the University of Carolina, Bouquet (1980) in France, Mortensen et al (1994) at the University of Florida, Ramming (1995) in Fresno, Goldi (1988), Walker (1994) at UC Davis. Microscopies studies revealed that the failure of pollen tube to reach the embryo sac (Lu and Lamikanra, 1996; Olmo, 1955). Most hybrids have been sterile, but a few have a low level of fertility. Our results basically agreed with the previous finding that hybrids were extremely difficult to produce when muscadine grapes were used as the seed parent and pollinated by *V. vinifera*. Advantage to using muscadine as the female parent is that fresh *V. vinifera* pollen can be used for pollination of muscadines the same season, since

V. vinifera grapes always bloom a few weeks earlier than *V. rotundifolia*.

Absolute sterility of male gametophytes and high or partial one of female gametophytes, specific to distant hybrids of F_1-F_2 has remained intact.

In addition to standard breeding techniques, tissue culture and protoplast fusion methods are being employed with the hope of developing fruitful hybrids through backcrossing program to develop both *V. vinifera* and *V. rotundifolia* cultivar types.

The authentic synthesis of new genome has been initiated by backcrossing, in situ conditions with including hybrids DRX-55 (*Aramon* x *V. riparia*), parental species, the hybrids *Seyvy Villari*, poliploids and varieties of *V. vinifera* (Топалэ, 1983).

In generation F_5 under ex situ condition, the synthesis of new genome of grapevine has been finished irreversibly by moving the odd chromosome in cytoplasm, fact attested by counting the chromosomes in somatic cells ($n=19$, $2n=38$) and judging according to normal size form of pollen grains, similar to bisexual varieties of grapevine. Among hybrids of F_5 have been revealed synthetic species of grapevine: *Vitis vinifolia* Top., *Vitis rotundifera* Dad. *Vitis crucestiana* Top. which are considered the exponents of new genome of grapevine (Topală, Dadu et al, 2005; Topală, Dadu, Ivasișin et al, 2011). This synthetic species are growing on proper roots and fertilizing normally in the Scientific and Practical Institute of Horticulture and Food Technology (Moldova).

The authentic intersubgeneric hybrids were identified based on biological characteristics and several features clearly indicated that they are really true hybrids. The hybrids had larger, elongated leaves while the muscadine grapes are characterized with small, round leaves. The hybrids had more and deeper lobes, longer teeth on the leaves than *V. rotundifolia* although they were not as deep as typical *V. vinifera* grapes. Leaves of muscadine grapes are generally thicker, with a waxy and smoother surface than those of *V. vinifera*. The leaves in the hybrids were intermediate between *V. rotundifolia* and *V. vinifera* in terms of thickness and smoothness. Overall, the leaves of the hybrids looked more like those of *V. vinifera* grapes. The tendril is an excellent marker to distinguish muscadine grapes from bunch grapes. Muscadine grapes have simple tendrils while bunch grapes are characterized

by branched tendrils that have about the same length for both branches. Tendrils of the hybrids were also branched but one branch was much shorter than the other, forming typical one and a half branches. The other distinct features that separates the hybrids from the parents are the mature stem. The hybrids, like the *V. vinifera* parents, have thick and rough bark which can be peeled off the rest of stem, while *V. rotundifolia* has thin smooth skin that will stay, tightly attached to the trunk even after the vines are fully matured. The muscadine grapes has a continuous pith through nodes, while pith in the hybrids and bunch grapes was discontinuous at the nodes. Other biological characteristics such as the times of bud burst and bloom were also distinct among the parents and the hybrids. The *vinifera* grapes broke bud and bloomed about a month earlier than the muscadine grapes, while the hybrids were in between the parents.

Based on hybrid DRX-55, a new species of crop *Vitis vinifera* L. were considered the similar to that cultivated on proper roots before *Phylloxera vastatrix* Planchon appearance and being distinguished by hybridogenous origin and high degree resistance.

In fact that with the aid of distant hybridization method we can create forms which superpose in a single genotype the quantity and quality of harvest of the species *V. vinifera* L., and with resistance to phylloxera of *V. rotundifolia* Michx was established.

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