

INTERSPECIFIC RHIZOGENE GRAPEVINE VARIETIES FOR ECOLOGICAL VITICULTURE

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Summary. Following the increasingly pronounced climate changes that have taken place in recent years, there is an acute need to revive the traditional grapevine assortment in order to reduce the influence of harmful phenomena on grapevine harvests and ensure their stable production in conditions of frequent climate disruptions. Due to the reduced genetic plasticity of *Vitis vinifera* grapevine species, there is an urgent need of revitalizing the viticultural assortment with new genotypes whose main characteristics are high adaptability to abiotic environmental factors but also resistance and tolerability to some pathogens and pests specific to grapevines.

Keywords: *Vitis vinifera*, *Muscadinia rotundifolia*, hybrid, interspecific genotypes, viticulture, genetical plasticity.

Introduction

In the last decades we observe more often negative climate changes and a increasing frequency of natural disrupting phenomena both during the vegetation period of the plants and in the state of vegetative rest. This fact affects the normal development of grapevine plants, their vegetation process and as a result the grape harvest. The main goal of modern viticulture is to obtain high quality production with minimal resource consumption. High quality grapes and wine derivatives can be ensured if three main factors are taken into account: the genotype (variety), location of the plantation (soil and climatic conditions) and applied technology (cultivation and processing). Therefore it is an urgent need to revive the viticultural assortment and adapt it to the changing environmental conditions. With this purpose, after many years of selection and hybridization there were obtained interspecific hybrids of *Vitis vinifera* and *Muscadinia rotundifolia* with a very high adaptation capability to abiotic factors and also tolerant to most grapevine pests and diseases. These genotypes are an appropriate response to the ever-increasing needs of modern viticulture and grapevine production.

The intraspecific genotypes (*Vitis vinifera*) have a wide capacity of use, but at the same time do not ensure the overcoming of climate change barrier. This is why, taking into account the functionality of genotypes and the use of technical algorithms and interspecific hybridization methods, more plastic rhizogenic interspecific genotypes are to be created in terms of their adaptation to climate changes, with beneficial repercussions on the sustainable development of the viticultural sector. As a result of crossing *V. vinifera* L. with *M. rotundifolia* Michx. interspecific grapevine genotypes were obtained and identified, their implementation will allow the expansion of vine cultivation area to the northern areas, at the same time reducing the number of chemical treatments, which will contribute to obtaining ecological products and assure environmental protection. Interspecific rhizogenic genotypes have an early period of grape ripening, they can be multiplied by cuttings, without grafting, thus obtaining rhizogenic planting material that contributes to reducing the costs of setting up grapevine plantations.

Grafting is a rather complex, risky and expensive technological process that requires special technical and practical knowledge, which consists in obtaining the plant from the joining of two different plant segments from both a genetic and morpho-anatomophysiological point of view. This represents nothing more than a symbiosis of the two partners (3).

Approved as table grape varieties: "Malena", "Nistreana" and "Algumax" and grape varieties for fresh consumption and processing: "Augustina", "Alexandrina" and "Ametist" (2). Also, following the hybridizations carried out in recent years, several hybrids were highlighted that deserve to be propagated and are to be tested under production conditions. The creation of plantations will contribute to the expansion of the area at the northern limit of vine cultivation.

Materials and methods

As object of study had served interspecific rhizogenic grapevine genotypes with table grapes "Malena", "Nistreana" and "Algumax", as well as grapes for fresh consumption and processing: "Augustina", "Alexandrina", and "Ametist"(3) and also some unnamed interspecific hybrid combinations. The respective genotypes are planted in the experimental grapevine sector of the institute. The management technique (forming/shaping) of the plants determines the habitus of the stump, in this case was used the unilateral, bilaterally single-tiered horizontal cord system, with one or two stems and the height of 80 cm, with the vertical management of the shoots(1).



Augustina



Nistreană



Ametist



Alexandrina

Figure. 1. Interspecific rhizogenic grapevine genotypes (*Vitis vinifera* L. x *Muscadinia rotundifolia* Michx.)

Interspecific grape varieties such as **Ametist**, **Alexandrina**, **Malena**, **Algumax**, **Nistreană**, and **Augustina** are notable for their enhanced rhizogenic properties, which allow for better root development and adaptability. These varieties are primarily derived from hybridization between

Muscadinia rotundifolia and **Vitis vinifera**, combining desirable traits from both species. Below is a detailed description of each variety:

1. Ametist

Description: Ametist is a hybrid variety characterized by its robust growth and excellent root system. The name "Ametist" suggests a richness in flavor and aroma, reminiscent of the gemstone. Produces large, dark purple grapes with a distinctive sweet flavor profile. High yield potential with clusters that are condensed and evenly sized. Mid to late ripening, making it suitable for various climatic conditions. Exceptional resistance to common diseases and pests, including downy and powdery mildew. Ametist demonstrates enhanced root architecture, allowing for deep soil penetration and greater resilience to drought conditions. This variety is particularly suited for less fertile soils where nutrient uptake is critical.

2. Alexandrina

Description: Alexandrina is a versatile hybrid variety known for its excellent balance of acid and sugar, producing grapes ideal for both fresh consumption and winemaking. Typically produces medium-sized, greenish-yellow berries that develop a golden hue at full ripeness. Balanced flavor with floral and muscat notes, appealing to both consumers and winemakers. Moderate to high yields with good cluster uniformity. Thrives in a range of climates, particularly those with warm summers. Alexandrina demonstrates a strong and fibrous root system, which allows it to access moisture and nutrients efficiently. Its adaptability to varying soil types enhances its suitability for diverse growing conditions.

3. Malena

Description: Malena is recognized for its resilience and rich taste, catering to both table grape consumers and winemakers. Produces large, green to slightly yellow berries that are crisp and juicy. Sweet, with a hint of acidity that enhances its refreshing taste. High productivity, with an ability to withstand adverse weather conditions. Strong resistance to fungal diseases, ensuring healthy crops. The variety exhibits a well-developed root system that enables it to thrive in various soil conditions, making it less dependent on external irrigation. This trait is critical for regions facing water scarcity.

4. Algumax

Description: Algumax is an innovative hybrid that stands out for its high adaptability and unique flavor profile, catering to niche markets. Produces yellow-greenish grapes that are visually appealing. Rich flavor with hints of citron-muscat, making it suitable for both fresh consumption and fermentation. Consistent yields with strong fruit set, even in challenging conditions. Largely focused on the production of high-quality wines.

Algumax's robust rhizogenic characteristics enable it to develop an extensive root network, enhancing its drought resistance and nutrient absorption capacity. This adaptability is particularly beneficial for vineyards in diverse ecological zones.

5. Nistreană

Description: Nistreană is renowned for its unique flavor and balanced acidity, making it popular among local grape growers. Produces large-sized grapes with a greenish-yellow to light amber coloration. Offers a complex flavor profile, combining sweetness with a refreshing acidity. Moderate to high yields with good fruit quality. Performs well in both moderate and warm climates. Nistreană features a strong root system that aids in moisture retention and nutrient uptake. This variety is known for its resilience, particularly in sandy or depleted soils.

6. Augustina

Description: Augustina is celebrated for its vigor and suitability for various winemaking processes, showcasing traits favorable for both fresh consumption and wine production. Produces large, yellow to slightly pink grapes that are attractive and flavorful. Noted for its aromatic profile with pleasant floral notes, ideal for sweet white wines. High yielding, consistent with good fruit quality and size. Thrives best in regions with warm summers and cooler autumns. Augustina

develops a deep and extensive root system, which enhances its drought tolerance and allows it to utilize a broader range of soil nutrients. This variety is particularly advantageous for sustainable viticulture practices due to its resilience and adaptability.

Results and discussions

The climatic changes that occur in the last decades and global warming processes cause at a global level an increased frequency of disruptive phenomena as drought, hails, flood, and others. Those often affect normal plant growth and yield establishment. A new approach in the complicated process of facing climate changes is the creating of resistant grapevine varieties.

In the process of creating new grapevine genotypes, it is necessary to pay special attention to functional-technological properties, such as: - cultivation technology; - performance/productivity (in relation to the vegetation period and pedoclimatic zone); - the balance between growth and fruiting; - the histo-anatomical, biochemical and physiological character; - resistance to diseases and pests; - the relevance of resistance to low temperatures; - the ripening term of grapes; - the chemical composition of berry juice and derived products; - the attractive appearance of the grapes; - the crunchiness and consistency of the flesh; - aroma and taste; - resistance to cracking of berries; - transport and storage capacity; - the direction of use of the grapes; - waste recovery, as a result of grape processing. Based on the functionality of the genotype, the existence of balanced, sustainable and diversified agroecosystems will be ensured in the future, which will guarantee the rational use of natural resources and a beneficial environment for the development of society (2).

The current requirements of the wine sector require the creation of new varieties with stable productivity potential, high quality of grapes and wine products. As a result of crossing the genotypes of *V. vinifera* L. ($2n=38$) x *M. rotundifolia* Michx. ($2n=40$) were obtained and homologated interspecific rhizogenic grapevine genotypes with table grapes: "Malena", "Nistreană" and "Algumax" and with grapes for fresh consumption and processing: "Augustina", "Alexandrina", "Sarmis" and "Ametist", which allow the expansion of the northern area of vine cultivation on own roots and the reduction of the number of chemical treatments, which will contribute to obtaining ecological products and protecting the surrounding environment. These genotypes can be multiplied by rooting cuttings. The plants obtained are rhizogenic and allow the exclusion of some practical steps from the technological process, which contributes to the reduction of financial resources for the production of planting material and the cultivation of vines.

Together with the existent rhizogenic varieties presented above, there were identified some promising hybrid combinations, that are to be tested and appreciated on their harvest quality and stability and other necessary parameters.

After the hibridations that were performed in the last 5 years of studies were identified and are to be tested about 25 hybrid combinations. Some of the most promising are presented below:



Hybrid no. 1



Hybrid no. 2



Hybrid no 3

The hybrid nr.1 has round crispy berries, big grapes with a light purple color, it is a very early ripening selection with a sweet good taste.

Hybrid nr. 2 has dark purple berries of an ovoidal shape, medium sized grapes with balanced sweet taste.

The hybrid under nr. 3 is a very early ripening selection, with conical berries and a very beautiful light amber-yellow colour and a very pleasant taste.

These hybrids will be tested further in order to obtain more information about their yield quality and stability and their resistance to abiotical and biotical factors. And also presented below is the evolution of interespecific rhizogenic seedlings in the experimental field.



Figure 3. The aspect of growing hybrid seeds obtained in 2023.

Conclusions

The implementation of interspecific rhizogenic grapevines can extend the area of grapevine cultivation towards the Northern area of the Republic of Moldova.

The improvement of viticultural assortment can be achieved more easily with the cultivation of new interspecific, rhizogenic varieties, which show increased resistance to biotic and abiotic factors, including extreme climate factors.

The process of obtaining ecological grapevine production can be simplified by using interspecific rhizogenic hybrids that demonstrate an increased tolerance and can assure a high yield.

The further establishment of new vineyards can be afforded by grapevine cuttings multiplication performed by the owners of the plantations.

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References

1. Alexandrov E. Crearea genotipurilor interspecifice rizogene de viță-de-vie. Chișinău, 2020, Tipogr. "Lexon-Plus".
2. Alexandrov E., Botnari, Gaina B. Soiuri interspecifice rizogene de viță-de-vie. Particularități de cultivare. Chișinău, 2020, Tipogr. "Print-Caro".
3. Dobrei A., Mihaela Mălăescu, Alina Ghiță, Sala F., Ioana Grozea. Viticultură: bazele biologice și tehnologice. Timișoara, 2011, Tipogr. Solness.