

Use of hybrids in viticulture. A challenge for the OIV

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Abstract

Abstract: Sustainable viticulture is one of the main challenges for our sector, and one possible solution is the use of resistant hybrids. The OIV, as an intergovernmental organisation, works in this area with a goal of harmonising definitions for all grapevine materials, including hybrids. It should be noted that hybrids are commonly used in non-European countries, and not only for research purposes. Some project resolutions have been discussed in the past and some of them are being developed by the OIV. However, before going deeper into the harmonisation processes, some genetic aspects should be defined in order to establish an international scientific consensus. Once this is accomplished, the OIV could then discuss the pressing issue of labelling or regulations on the denomination of varieties and also of the wines produced for the entire vitivinicultural sector.

Keywords: hybrid, clone, *V. vinifera*, *V. amurensis*, *Muscadinia*, resolution.

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Introduction

The use of hybrids in viticulture is currently being discussed in our sector, which is facing relevant challenges including sustainable production within the framework of reducing pesticides, adapting to climate or controlling vine decay. The use of grapevine plant material could give new perspectives to solve these problems.

Nevertheless, not all the countries accept this material for making commercial wines. This is not a new discussion within OIV meetings. Some previous project documents have been presented, the most recent in 2015 titled “definition of grape varieties with introgressed disease-resistant genes from wild relatives”. This document discussed the issue of intraspecific hybrids from *Vitis vinifera*, when one or more gens from wild American species are first used, as well as from Asian species, repeatedly backcrossed to *V. vinifera* cultivars with the objective of transferring the resistances into the *vinifera* genetic background and restoring the *vinifera* genetic background for traits dealing with oenological aptitude.

Besides certain benefits like resistance to downy and powdery mildew, there are still some concerns that should be addressed before adopting any new resolution. These concerns are of both organoleptic (foxy aroma and strawberry flavours in wine) and compositional nature (high methanol or malvidol content).

It should be noted that the OIV definition of wine is as follows: “Wine is the beverage resulting exclusively from the partial or complete alcoholic fermentation of fresh grapes, whether crushed or not, or of grape must”, and that the official OIV grapevine varieties and synonyms database does not make any difference between *V. vinifera* and the other genera.

Evidence of hybrids’ utilisation worldwide

Mainly, but not uniquely, for research purposes, the use of hybrids is common in non-European countries. For instance, sparkling wines in Brazil are frequently based on *V. labrusca* and hybrids (Caliari *et al.*, 2014). Moscato Embrapa, Niagara, Villenave, Goethe and Manzoni Bianco are some of the varieties widely used in Brazil for wine production. In Rio Grande do Sul (Brazil), only 7% of the vineyards are planted with European grape varieties, the rest being American or hybrid vines, like Cabernet Cortis, Cabernet Carbon, Bronner or Regent (de Bem *et al.*, 2016).

It is also well known that *Muscadinia rotundifolia* has some resistance factors, which makes it an interesting cultivated species from the southeast of the United States that researchers have studied for its total resistance to powdery and downy mildew, even if some technical difficulties exist when crossing with *V. vinifera*.

China started selection and breeding programs for table and wine grapes in the 1950s, with the main aim to cultivate red grapes with cold resistance (Li, 2014). *V. amurensis* (very resistant to low temperature) was used for intraspecific hybridization breeding programs with *V. vinifera* varieties whose fruits have high sugar and low acidity (such as Müller-Thurgau, Merlot, Riesling, Cabernet-Sauvignon, Vidal and Chenin Blanc). More than 73 combinations (Gongniang, Beichun, Beihong, Beimei, Shuangqing, Shuangyou, Shuangfeng, Shuanghong, Zuohongyi, Zuoyouhong, Xuelanhong, and the icewine variety Beibinghong) were tested and planted. Currently all of these varieties are used for production with thousands of hectares planted, even in Shuangyashan where the latitude is 46°N; they have become the important raw materials for winemaking in the northeast of China.

Another example is *V. quinquangularis* Rehd in the Guangxi province. Researchers are working on hybrids of *V. quinquangularis* Rehd from Du’An County and European grapevines (NW196, NW213, NW296 and NW741). Commercial wines (e.g. Mi Luo Tuo *V. quinquangularis* Rehd grape Dry Red Wine) have risen in the market and they have high tannin (on average 32.5 g/100 mL) and anthocyanin content and high acidity (15 g/L or even higher, when calculated as tartaric acid).

Furthermore, the Korean grape cv. ‘Cheongsoo’ is a hybrid (*V. vinifera* - *V. labrusca*) between Seibel 911’ and Himrod Seedless (Chang *et al.*, 2014.) grown at the Gangwon Provincial Agricultural Technology Institute, Korea (Yun and Park, 2007), which was selected in 2005 for its good winemaking performance, and also because *V. labrusca* hybrid cultivars, which usually contain the haplotype A2, show higher anthocyanin contents (Kim *et al.*, 2015).

In Europe, there are some interspecific hybrids that are produced by crossing *V. vinifera* and certain other traits of *Vitis* spp. Aletta, in particular (Hungary), is one of these hybrids: it was qualified in 2009 by the Hungarian register, in 2012 its surface area was 423 ha and now accounts for 1300 ha (Hajdu, 2015). France has recently created a National Observatory

for the development of resistant grape varieties (OsCar), Germany and the PIWI family, etc.

Therefore, hybrids are being more frequently used in the wine world, and in addition, there is no new strategy for being resistant against cold, diseases or other factors.

Previous discussions: Malvidol

In the past, some project resolutions have been presented related to malvidol. In the OIV compendium of international methods of wine and must analysis, a method is described for analysing malvidol (OIV-MA-AS315-03 377/2009; OIV, 2009). Moreover, in the annex C of this compendium, a maximum acceptable limit of malvidol content (15 mg/L) is established for wine. More than 10 years ago, one discussion about malvidol took place at OIV (OIV, 2003 and 2004) and finally no resolution for solving this problem was adopted, because some members argued that malvidol could cause occasional health problems.

In several European countries, new cultivars derived from various breeding programs, which are classified and released for the production of quality wine, exceed the OIV threshold for malvidol.

The discussion about malvidol will come up again, because in some European regions former registrations of new cultivars were withdrawn, referring to OIV standards because concerned varieties exceeded the mentioned OIV threshold for malvidol content.

Definitions about hybrids in viticulture

The vine belongs to the *Vitaceae* family, which is divided into different genera. At the present time, there are 19 recognised genera that make up this family, including the *Vitis* genus (Arvani *et al.*, 2015). This genus is in turn divided into two sub-genera: the sub-genus *Muscadinia*, which today includes two species, and the sub-genus *Vitis*, which comprises over 80 species originating from i) Asia (e.g. *V. amurensis*, *V. piasezkii*, etc.), ii) North America (e.g. *V. labrusca*, *V. aestivalis*, *V. berlandieri*, *V. riparia*, *V. rupestris*, etc.) and iii) Eurasia (*V. vinifera*). *V. vinifera* species are divided into two sub-species: *V. vinifera* subsp. *sylvestris*, which corresponds to wild vines, and *V. vinifera* subsp. *vinifera*, which corresponds to cultivated vines.

Vitaceae is a complex family with many possible inter and intraspecific crossings. Due to this complexity, the OIV is currently working on the establishment of new definitions in relation to the

classification of grapevine material used. The Genetic resources and vine selection (GENET) group of experts from Commission I decided to start a new project resolution (VITI GENET 16-610 project resolution) in 2016, and an electronic working group was established in order to present a draft during the next meetings in April 2017.

This draft includes the provisional definitions for cultivated variety (variety), vine variety, clone, intraspecific hybridization, interspecific hybrid, direct-producer hybrid and resistant variety.

Current political and technical considerations

As the intergovernmental, scientific and technical reference organisation for wine and viticultural products, the OIV has as one of its objectives to contribute to the international harmonisation of existing practices and standards and, as necessary, to the preparation of new international standards. Regarding the harmonisation of grapevine plant material, the OIV is working on two project resolutions:

- VITI 14-564. OIV process for the clonal (A) and polyclonal (B) selection of vines (OIV VITI 564A-2017; OIV, 2017).
- VITI 14-565. OIV recommendations for production, certification and trading of viticultural plant material: Sanitary (A) and Genetic (B) aspects.

It is important for the OIV and for the entire vitivincultural sector to define this grapevine plant material and to establish standards for vine selection or trading, in order to avoid further misunderstandings. For instance, there are OIV resolutions (such as VITI 1/1991; OIV, 1991) that employ these concepts, but without any definition given. Therefore, we could consider a different meaning for each one depending on different texts (this is not advisable for the resolutions' harmonisation). Before moving further toward harmonisation, we should define the previous mentioned concepts at an international level for the vitivincultural sector.

Nevertheless, when we are trying to define a clone, variety, hybrid, etc. or some limits in the viticulture scientific community, some questions arise:

- How many genotypes should be equal in order to be sure that it is the same cultivar or not, when two different plants are compared? 95%, 99.5%? Even within *V. vinifera* species this is not defined.

- How many years (or generations) should be evaluated in order to stably fix a gene (or genes) in the genetic background of one variety?
- Should names of varieties be protected from new appellations if there is not enough common genotype? How many or where are the limits?

Conclusions

There is a growing demand for sustainable, environmental friendly viticulture, and one possible solution is the use of resistant hybrids. The OIV, as an intergovernmental organisation, is working in this area for harmonising the definition of all grapevine plant material, including hybrids.

The lack of harmonised international definitions, denominations and practices could become barriers to trade and create unfair competition, affecting companies' innovation and competitiveness.

However, before advancing further in the harmonisation process, certain genetic aspects about the techniques (back-crossing and retro-crossing) or criteria (years or generations, percentage of *vinifera* genotype, percentage of cultivar genotype, minimum of similar OIV descriptors, ampelography traits, molecular markers, etc.) should be defined. This would allow for an assessment within an international scientific framework before discussing labelling or regulations on the denomination of varieties and their produced wines.

Therefore, an international consensus about these scientific questions is urgent for the OIV and the vitivicultural sector worldwide.

Note : The opinions expressed in this document are those of the author(s) and do not reflect the views or the opinion of the OIV. Only the resolutions adopted by the Member States of the OIV have an official character.

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