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Inovações, património, economia e mercados da vinha e do vinho em dois grandes países produtores de vinho da América do Sul, Argentina e Brasil

Saving Argentine Malbec: Preserving Genetic Diversity in a Millenary Grape Varietal

Sauver le Malbec argentin : préserver la diversité génétique d'un cépage millénaire

Salvar el Malbec argentino: preservar la diversidad genética de una variedad de uva milenaria

30 December 2023.

Adrianna Catena, Fernando Buscema, Diego Lijavetzky, Sebastián Gomez Talquenca Luciano Calderón

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PREO

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- 1 With nearly 40.000 planted hectares, Argentina is home to the greatest genetic reserve of Malbec in the world. A native of Cahors, the offspring of Madeleine Noir de Charentes and Prunelard, Malbec has remained in use and prevalent over millennia—a testament to its resilience and popularity. While the importance of this varietal in France has waned since the mid-19th century—a consequence, in part, of the devastation caused by phylloxera—Malbec found a second home in Argentina, and notably in the province of Mendoza, where it was introduced around 1853 by the French agronomer Michel Aimé Pouget. Today, the region holds a veritable genetic treasure of pre-phyloxeric, ungrafted vines—our efforts are aimed at highlighting this treasure and enduring its survival.
 - 2 This collaborative, interdisciplinary study brings together scholars in the fields of genetics, viral diseases, viticulture, enology, and history to shed light on the fundamental role of Argentine Malbec in the larger preservation and survival of this varietal. Drawing on evidence

from ongoing research, our presentation considers the broader importance of genetic diversity today, highlighting the uniqueness of the Argentine context and detailing our own role in the preservation of this varietal: in relation to both the health of our vines and their genetic diversity. Our main aim is the recognition of this varietal as an ancient, emblematic variety and cultural patrimony of humanity. We are impelled in this endeavor by the particular circumstances of Argentina—the unique diversity of Malbec in this area—as by the need to safeguard the future of Malbec in a context of climatic change.

- 3 **Genetic diversity of Malbec cultivar in Argentina:** genetic diversity is low between clones within a clonal-propagated cultivar such as grapevine. However, genetic events, such as somatic mutations, still occur and accumulate over time. Grapevine cultivars were derived from sexual crosses and clonally propagated to preserve their unique traits. Malbec presents remarkable clonal phenotypic diversity and a great capacity for adaptation. However, little is known about its clonal genetic diversity. The first large-scale results were recently achieved using whole genome resequencing for four different clones and the identification of 941 informative polymorphisms (DOI: [10.1038/s41598-021-87445-y](https://doi.org/10.1038/s41598-021-87445-y) (<https://www.nature.com/articles/s41598-021-87445-y>)). After evaluating 214 Malbec accessions, 14 different genotypic patterns were identified that were grouped into two genetically divergent clonal lineages (FR and AR). The genotypes included in the FR group are closely related to the accessions close to the origin of this cultivar in France or introduced into this country during the last 30 years. The genotypes of the AR group are closely related to accessions with a longer clonal propagation time in Argentina (>70 years), suggesting a closer link with those first plants introduced from France during the 1850s. In other words, what is usually observed at the phenotypic expression level now has genotypic support.
- 4 A more immediate threat to Argentine Malbec is viral diseases: Argentina maintained a strikingly low viral presence until the 1990s, a situation that has since shifted—a negative outcome of the industry’s explosive export boom—despite strict legislation and governmental control on the entry of plant materials. Grapevine is affected worldwide by a large number of pathogens with a potentially high economic impact. They include more than 80 known viruses, several of these associated with severe diseases transmitted through propaga-

tion material. Thirteen of more than 80 viruses have already been reported in Argentina. While cultural practices are still employed to handle viral outbreaks (primarily the replacement of diseased vines with healthier new ones), the main tool used for the control of viral diseases is the use of virus-free planting stock, obtained through sanitary selection. This selection is based on an evaluation of the sanitary status of promising plants, with the aim of choosing virus-free plants using the most advanced diagnostic techniques. Yet the rising number of viral entities described in recent years has made healthy vines increasingly hard to find. As the main genetic reserve of Malbec in the world, Argentina is ideally suited to a trial selection program. However, the selection of healthy Malbec genotypes could lead to a severe process of genetic erosion. Consequently, the use of advanced techniques for sanitation (meristem tip culture, somatic embryogenesis) of highly valuable genotypes is an attractive pathway for preserving and valorizing the genetic diversity of this cultivar of such significance for the worldwide wine industry. This would increase our ability/readiness to adapt to changing climatic conditions. Inefficient use of resources: plants with viruses produce less.

- 5 In 1995, under the direction of the Catena Institute of Wine, we initiated a program geared towards the preservation of 135 pre-phylloxeric, ungrafted Malbec clones drawn from old vineyards in the region of Mendoza, which we later named the Catena Cuttings. Over the past five years, we've taken this project a step further, building a nursery of virus-free plants including the Catena Cuttings and exemplars from other varieties such as Cabernet Sauvignon, Chardonnay, Pinot noir and the native Criolla. Malbec has been grown and vinified for over a thousand years. Key to its future is the study and preservation of genetic diversity, and the propagation of virus-free plants.

English

Against a backdrop of climate change and loss of biodiversity, preserving traditional grape varieties and their genetic diversity remains a major challenge for the future. The Catena Institute, in association with a number of Argentinian researchers, has embarked on a project of this kind, focusing on a grape variety that originally came from south-west France but is now emblematic of the Argentinian vineyards: Malbec. As well as outlining the specific characteristics of Argentine Malbec and its genetic diversity, this con-

tribution explains the work being done to preserve it. It looks at the health of the vines as much as their genetic diversity, with the ultimate aim of ensuring the survival of Malbec and gaining recognition for it as an ancient variety, a veritable cultural heritage for humanity.

Français

Dans un contexte de changement climatique, de perte de biodiversité, la préservation des encépagements traditionnels et de leur diversité génétique reste un enjeu majeur pour le futur. L'Institut Catena, en association avec plusieurs chercheurs argentins, s'est lancée dans un tel projet ciblé sur un cépage initialement venu du Sud-ouest de la France mais désormais emblématique du vignoble Argentin : le Malbec. Tout en évoquant les spécificités du Malbec argentin et sa diversité génétique, cette contribution explique le travail engagé dans sa préservation. Il s'intéresse à la santé des vignes autant qu'à leur diversité génétique avec, in fine, un objectif à atteindre : assurer la survie du Malbec et le faire reconnaître en tant que variété ancienne, véritable patrimoine culturel de l'humanité.

Español

En un contexto de cambio climático y pérdida de biodiversidad, la preservación de las variedades de uva tradicionales y de su diversidad genética sigue siendo un gran reto para el futuro. El Instituto Catena, en asociación con varios investigadores argentinos, se ha embarcado en un proyecto de este tipo, centrado en una variedad de uva originaria del suroeste de Francia, pero hoy emblemática de los viñedos argentinos: la Malbec. Además de exponer las características específicas del Malbec argentino y su diversidad genética, esta contribución explica el trabajo que se está llevando a cabo para preservarlo, tanto en lo que respecta a la salud de las vides como a su diversidad genética, con el objetivo último de garantizar la supervivencia del Malbec y lograr su reconocimiento como variedad ancestral, auténtico patrimonio cultural de la humanidad.

Mots-clés

Malbec, diversité génétique, cépage, conservatoire

Keywords

Malbec, genetic diversity, grape varietal, conservatory

Palabras claves

Malbec, diversidad genética, variedad de uva, conservatorio

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