A PRELIMINARY INVESTIGATION OF *VITIS VINIFERA L.* DIVERSITY IN *VINHA-DO-ENFORCADO* IN LOUSADA

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RESUMO

A paisagem agrícola é enriquecida pela presença de formas e variedades de vinha que valorizam a sua estética, sobretudo, em regiões onde a viticultura é praticada há séculos. Nessas mesmas áreas agrícolas, é ainda possível encontrar antigas castas autóctones, cuja presença é preciosa para a manutenção da diversidade vitícola, que atualmente se encontra ameaçada pela adoção de sistemas de cultivo intensivos e especializados. Urge pensarmos em estratégias para preservar esta riqueza vitivinícola, que inclui formas tradicionais de cultivo, como a vinha-de-enforcado, e a preservação de castas nativas ancestrais. Essas estratégias devem também procurar garantir a sustentabilidade económica e social associada à salvaguarda deste património cultural, nomeadamente através da remuneração adequada dos viticultores que se dedicam a formas tradicionais de cultivo e ao cuidado de vinhas – por vezes centenárias – que exigem custos adicionais de gestão. O primeiro passo para a preservação é evitar a destruição das estruturas de condução e proceder ao inventário das variedades presentes nestas vinhas antigas. É necessário atribuir nomes a estas castas, partindo do conhecimento oral dos agricultores – verdadeiros guardiões desta diversidade – bem como da sua caracterização morfológica. O nosso contributo representa um primeiro passo, com forte valor educativo, dado que o trabalho e a atividade de investigação foram realizados por alunos de uma escola italiana de viticultura, acolhidos em Lousada. O envolvimento das gerações mais jovens funciona como motor para a disseminação do conhecimento adquirido, esperando-se que daí surja uma consciência profunda do valor do seu próprio *terroir*.

KEYWORDS

Identificação de variedades, Lousada, paisagem vitícola, variedades autóctones ancestrais, *vinha-do-enforcado*, vinhos verdes

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ABSTRACT

The agricultural landscape is enriched by the presence of forms of vineyards that enhance its aesthetic appearance in areas where viticulture has been practised for centuries. In the same agricultural areas, it is still possible to find old autochthonous vine varieties whose presence is precious for the vine diversity that is today endangered by the intensive and specialised system of cultivation. It becomes urgent to think of strategies to preserve this viticultural richness.This includes traditional forms of cultivation, such as Vinha-do-enforcado, and the preservation of ancient native vines. These strategies should also aim at ensuring the economic and social sustainability associated with safeguarding this cultural heritage, i.e. adequately remunerating winegrowers who focus on traditional forms of cultivation and varieties in sometimes centuries-old vineyards that require additional management costs. The first step for the preservation is to avoid the destruction of the trellises and to take a census of the varieties found in these ancient vineyards. It is necessary to assign names to these varieties, starting from the oral witnesses of the farmers who are the guardians of this diversity, as well as morphological characterizations. Our contribution is a first step with a strong educational value as the work and research activity were conducted by students from an Italian wine school hosted in Lousada. The involvement of younger generations acts as a driving force for the dissemination of the knowledge acquired, from which it is to be hoped that a deep awareness of the value of one's own terroir will arise.

KEYWORDS

Lousada, old autochthonous varieties, variety identification, Vineyard Landscape, Vinha-do-enforcado, Vinhos Verdes.

1 INTRODUCTION

The grapevine in its ancestral forms has been present on the face of the earth for millions of years. For about 10,000 years, after the last great ice age, its path crossed with that of man, who domesticated it and learnt to use it not only for its fruit, but also to create a fermented beverage: wine.

FIGURE 1 Ancient stone millstone, dating back to the late Middle Ages, found in Lousada, Mata de Grades – Vilar do Torno and Alentém, testifying the historical richness of Sousa superior wine-growing (September 2024).

Today, the thousand-year-old tradition of wine-growing in Europe is still expressed by a multitude of grape varieties, all related to *Vitis vinifera L.*, by a great variety of training systems in the different wine-growing environments, and by a varied cultural tradition related to wine. This heritage is particularly marked in Mediterranean European

countries such as Italy and Portugal, where hundreds of autochthonous grape varieties and dozens of different training systems can still be found today, alongside archaeological evidence that grapes have been made into wine in these countries since ancient times

FIGURE 2 *Vinha-do-enforcado* Casa da Porta – Vilar do Torno with the wooden ladder used during the grape harvest (September 2024).

Worldwide animal and plant diversity is a resource to be protected and is under continuous threat of erosion due to monoculture, use of a few clonal selected varieties from nursery propagation instead of autochthonous plants, urbanisation, introduction of exotic species, and pollution. *In situ* and *ex situ* plant species conservation can help us to intervene with genetic improvement, allowing us to adapt to changes in climatic and social scenarios. This goal has been focused on globally since 1974 by the International Board for Plant Genetic Resources, IBPGR (today Bioversity International), subsequently ratified by the Convention on Biological Diversity, CBD, in 1992, and it is present today among the goals of UN Agenda 2030.

The loss of genetic resources of *Vitis* species and cultivars is a worldwide phenomenon, resulting from the expansion of cultivation causing the loss of landraces and also from progressing civilisation and natural disasters (Mota *et al*, 2013). Today, old cultivars are neglected almost everywhere in the DOC regions and this situation is encouraged by DOC restrictive rules concerning the varieties that are permitted to be cultivated. That is to say, the appellations of origin of the respective territories have effectively impoverished the ampelographic platform representing the number and variability of vine varieties, especially in countries with a strong wine-growing tradition. This loss of viticultural diversity has also been accompanied by a standardisation in the management of vineyards and winemaking operations in the cellar. This technical evolution, while allowing for more economical management both in the field and in the cellar, jeopardises the survival of the more traditional vine-growing systems that have a strong cultural and historical value in countries with a strong winegrowing tradition. Autochthonous vines and traditional and local vine training systems can represent a resource on which to focus for the valorisation of

FIGURE 3 Mr José Pinto da Silva (born in 1943) with the typical wooden ladder made from a single trunk that is traditionally used for harvesting grapes in baskets on *Vinha-do-enforcado*.

FIGURE 4 View of Casa da Porta surrounded by its own vineyards.

FIGURE 5 Students and teachers from the Technical Agricultural Institute Vivarelli in front of villa Casa Da Porta.

territories and the protection of their viticultural and oenological culture. Wine-growing districts that are able to focus on this potential not only protect their vine diversity but can use it as an economic resource that emerging wine-growing countries cannot bring into play.

In Lousada, located in the district of Porto in north-west Portugal, there are interesting examples of indigenous vines trained in tree-lined rows. The *Casa da Porta* vineyard in Lousada, which is part of the pilot project of the micro-reserves networks of the Paisagem Protegida Local do Sousa Superior, has several vines trained on a system that is referred to as *Vinha-do-enforcado*. This traditional form of cultivation represents today, as in the past, an element of great interest both for its landscape charm and for its value in preserving diversity since it represents a preservation of ancient vines belonging to local varieties.

The municipality of Lousada is included in the *Vinho Verde* production area, which today is experiencing an increasing focus on the use of local vines as an element of valorisation of the area's traditional viticulture. The *Casa da Porta* wine-growing enterprise itself, embellished by the presence of a historical villa set in a protected landscape, has several ancient tree-lined vineyards and is at the same time an interesting modern wine-growing enterprise with its more than six hectares of vineyard area destined for the production of Vinho Verde.

2 THE PROJECT

Teachers and students from the post-diploma course in Oenology at the Technical Agricultural Institute Vivarelli, Fabriano – Italy, came to Portugal at two different times (May 2022 and September 2024) during internship activities to carry out ampelographic surveys on the *Vinha-do-enforcado* vines present on the *Casa da Porta* estate. *Casa da Porta* is a historical agricultural reality: it is a family business currently owned by Leonor Elisa Ribeiro de Carvalho Guimarães Correia de Sá and it is directly managed by the efforts of her daughter's, Leonor Correia de Sá.

Casa da Porta has been engaged in recent years in a project to conserve its historic vineyards, threatened by ever-increasing difficulties due to both high management costs and the advanced age of the workers. This interest was the starting point for this study, which focused on the analysis of four *Vinha-do-enforcado* vineyards on the property.

The work carried out was exploratory and preliminary in nature, with the aim of characterising the vine diversity present in the *Vinha-do-enforcado* through the description of vegetative and productive parameters. This observation was an opportunity for the students to apply their knowledge of descriptive ampelography to morphologically catalogue the ancient varieties present that are not derived from modern nursery material.

The morphological metrics of the vines present in traditional vineyards represents the first tool for taking a census of ancient varieties and allowing their preservation, a fundamental prerequisite for their valorisation. In Viticulture we have to refer exclusively to the OIV's *(Organisation Internationale de la Vigne et du Vin* – International Organisation of Vine and Wine) descriptor list for grape varieties (OIV, 2009). The description we carried out on the vines focused mainly on the primary descriptors such as the opening of the shoot tip, density of hairs, color of the young shoot, color of young leaf, shape of blade, number of lobes, shape of teeth, opening of petiole sinus, density of hairs in mature leaf, shape and color of skin in berry, shape and density of bunch. The characteristics used to distinguish varieties may be either qualitative, alternative, or quantitative. "Qualitative characteristics" should be those which show discrete discontinuous states with no

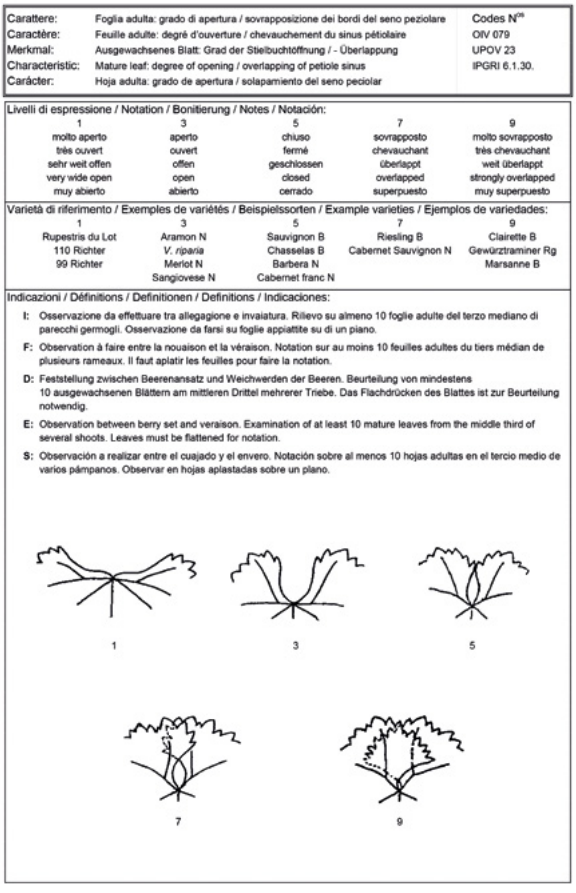

FIGURE 6 OIV Sheet (Code N. OIV 079 Characteristic: Mature leaf: degree of opening / overlapping of petiole sinus

FIGURE 7 Interview with Mr Joaquin Ferreira (1954-2023).

FIGURE 8 Interview with Mrs Helena Maria Conceição Vitorino

FIGURE 9 Interview with Mr José Pinto da Silva.

arbitrary limit on the number of states. "Quantitative characteristics" are those which are measurable on a one-dimensional scale and show continuous variation from one extreme to the other. They are divided into notes 1 to 9. For us, this experience has had a strong didactic value and, at the same time, has represented a moment of growth and cultural exchange, of relations and comparison with a traditional reality of great interest. Today, the classification and correct varietal attribution to the national catalogue of vines passes through the use of DNA analysis (Castro *et al.,* 2012), but this was not part of the objectives of our current project.

Our work began with the collection of verbal information from custodian farmers who were able to provide incidental historical information (Crespan *et al.* , 2021). This information is a fundamental element to support any further phase of ampelographic studies for the possible varietal attribution of new presumed accessions that may be found. At two different phenological stages, at pre-flowering in May 2022 and at maturity in September 2024, ampelographic surveys were carried out (OIV sheet) and three farmers who have been cultivating the vineyards for decades were interviewed.

Below are the characteristics of the four *Vinha-do-enforcado* vineyards.

1. Vinha Panelada

The *vinha-do-enforcado* is located along the Avenida de Paços road, in Torno, EN 207-2, and is protected by a stone wall. It is a *Vinha-do-enforcado* with a height of about 6 metres, planted with plane trees, and managed for decades with annual pruning of both vines and trees by Mr Joaquin Ferreira. Ferreira stated that the vineyard is at least 100 years old and that the rootstock used is the Corriola (suitable for that kind of soil). Three presumed black grape accessions attributed by Ferreira as *Vinhão Tinto, Vinhão Mais Claro* and *Verdelho*, and one white grape attributed to *Azal da Lixa branco* were observed and marked.

FIGURE 10 *Vinha-do-enforcado* Vinha Panelada (May 2022).

2. Vinha Quinta de Sousa

This is a *vinha-do-enforcado* about five metres high, planted with plane trees, with vines attributed to the *Espadeiro* cultivar. It is managed with annual pruning of the vines by Mr José Pinto da Silva, who has always been in charge of this vineyard since it was planted about 30 years ago, after the widening of the road that imposed the elimination of the old *Vinha-do-enforcado*. The present vines were multiplied by José himself by propagation through grafting in the field from 100-year-old mother plants, both for the rootstock (*Corriola*) and for the *Espadeiro* buds that are still to be found on the property of Leonor Elisa Ribeiro de Carvalho Guimarães Correia de Sá – Casa da Porta.

FIGURE 11 *Vinha-do-enforcado*
Vinha Quinta de Sousa (May 2022).

3. Vinha Lameiro de Casa ou de Baixo

Vinha-do-enforcado with a height of five metres, planted with plane trees, presumed to be about 100 years old, grown with annual pruning of both vines and trees by Mr Joaquin Ferreira over the last fifty years. The probable rootstock used is the *Corriola* (suitable for moisturized soils). On the observed section of the *Vinha-do-enforcado*, two different types of vines were marked, both named by Mr Ferreira as *Vinhão Mais Doce*, but appearing different based on ampelographic observation of the shoots.

FIGURE 12 *Vinha-do-enforcado*
Vinha Lameiro de Casa ou de Baixo (May 2022).

4. Vinha do Juncal

Vinha-do-enforcado with a height of approximately five metres high, planted with plane trees, at least with 100 years old, whose rootstock is not known and which is managed with annual pruning of both vines and trees by Ms Helena Maria Conceição Vitorino. On the section of *Vinha-do-enforcado* that was analysed, vines attributed to *Vinhão*, which Ms Helena calls "*Perfeito*" because she considers it particularly beautiful, and *Pinheiro Antigo* were observed. The latter is a type of *Pinheiro* of particular value because it has a beautiful large bunch and constant production.

FIGURE 13 *Vinha-do-enforcado*
Vinha do Juncal (May 2022).

The spatial location of the four *Vinha-do-enforcado* vineyards of Casa da Porta under observation is shown in the Figure 14.
The observations carried out during the two different times of the growing season, which corresponded to the phenological phases of pre-flowering and ripening of the grapes, made it possible to identify six presumed accessions which, on the basis of the evidence collected, were identified with the following names: *Vinhão Tinto, Espadeiro, Azal da Lixa branco,*

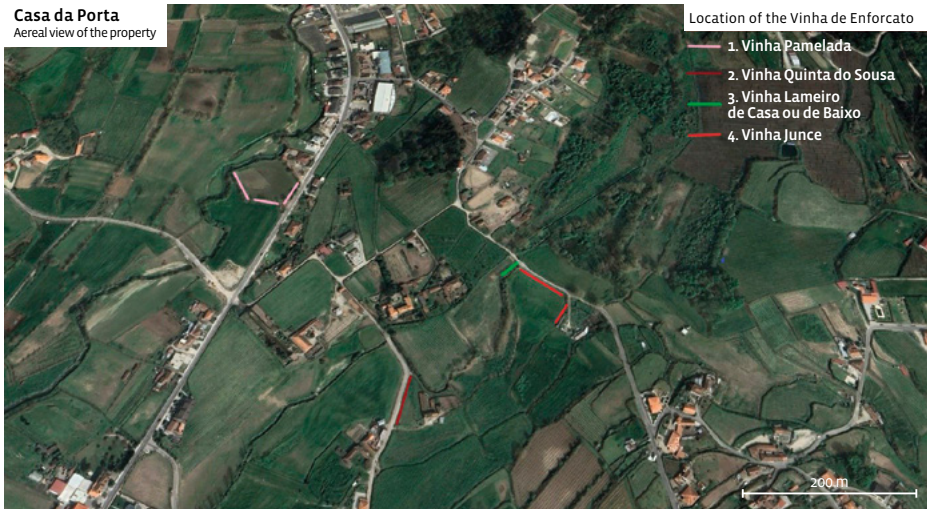

FIGURE 14 GMap aerial view of the *Vinha-do-enforcado* vineyards of Casa da Porta.

FIGURE 15 Bunch of vines attributed to *Espadeiro*.

DESCRIZIONE AMPELOGRAFICA PRINCIPALE

Variety: .....**Espadeiro**.....
Location: **Lousada Vinha-do-enforcado Vinha Quinta do Sousa Casa da Porta**

	Code OIV	Notes
Jeune rameau / Junger Trieb / Young shoot / Pâmpano joven/giovane germoglio	001:	5
	002:	1
	003:	1
	004:	1
	005:	1
shoot	006:	5
	007:	11
	008:	1
	009:	1
	010:	1
	011:	1
	012:	1
	013:	1
	014:	1
	015-1	1
	015-2:	1
Vrilles / Ranken	016:	1
	017:	3
Tendrills / Zarcillos Viticci		
Jeune feuille / Junges Blatt Young leaf / Hoja joven Ausgewachsenes Blatt	051:	3
	053:	3
	054:	1
	055:	3
	056:	1
Mature leaf Hoja adulta Foglia adulta	067:	3
	068:	2
	070:	2
	076:	2
	079:	3
	081-2:	1
	084:	3
	087:	1

	Code OIV	Notes
Fleur / Blüte Flower / Flor/Fiore	151:	3
Inflorescence / Infloreszenz	152:	2
Inflorescence/Infrorescencia	153:	2
Inflorescenza	155:	1
Grappe / Traube Bunch / Racimo Grappolo	202:	5
	203:	3
	204:	3
	206:	1
	207:	1
	208:	2
	209:	2
Baie / Beere Berry / Baya	220:	3
	221:	3
	222:	1
	223:	2
	225:	5
	226:	1
	227:	7
	229:	1
	231:	1
	235:	1
	236:	1
	238:	1
	240:	3

FIGURE 16 OIV sheet with characters relating to young shoot, inflorescence, adult leaf, berry and bunch at maturity.

Vinhão Mais Doce, *Pinheiro Antigo*, and *Verdelho*. It was not possible to fully detect the morphological characteristics for all of the presumed accessions found in the Vinha-do-enforcado of Casa Do Porta; moreover some of these characteristics are certainly linked to the age of the vines observed and may therefore differ from what is presumably observable in younger vines. As an example of the ampelographic observations made, the OIV character detection sheet for young shoots at pre-flowering, adult leaves, and berries and bunches at grape ripening for the *Espadeiro* variety is given below.

3 CONCLUSIONS

Focusing on the typical forms of cultivation of traditional viticulture, such as *Vinha-do-enforcado*, is linked to the value of preserving the landscape, viticultural, environmental and cultural diversity. Therefore, the preservation of such training systems deserves a lot of effort, but it can only succeed through the economic valorisation of the grapes produced with this training system, which is very labour-intensive since most of the operations in the vineyard are carried out exclusively by hand. Vineyard companies such as *Casa da Porta*, which still believe in the cultural and landscape value of *Vinha-do-enforcado*, must advertise this heritage maintained by the custodian farmers and use it to make their products unique and linked to the history of their territory.

The issue of genetic erosion of germplasm is particularly topical and pressing considering the age of those who manage traditional vineyards. In addition to this, the inevitable environmental changes changes, such as the design of new roads, the construction of new buildings, and the elimination of old boundaries, threaten the survival of the old *Vinha-do-enforcado*.

FIGURE 17 Vines labelled for further morphological and molecular investigations.

Overall, our preliminary work has given us the opportunity to study this training system and to establish some ideas for future work. An initial descriptive framework may be followed by a plan for molecular investigations for the purposes of varietal cataloguing and future evaluation of the vegetative and productive characteristics of the vines identified. Another possible objective could be the vinification of the grapes produced exclusively by the *Vinha-do-enforcado* vineyard with the aim of making the traditional system economically sustainable. To achieve this goal, it becomes fundamental to revisit certain technical elements of conducting and setting up the *Vinha-do-enforcado* from the point of view of the health and safety of the work site related to the height of the plants, which requires less dangerous technical solutions for the workers.

The accessions, characterised only in terms of morphology for now, may also be investigated in the future for wine grapes' productive aptitude. To do this, the first step is certainly to conserve them, then to carry out the correct identification of grapevine material. Identification of misnames, synonymies and homonymies is a complex task in viticulture. Nowadays the application of fast and reliable techniques, together with classic ampelography, allows a correct identification of grapevine material. Microsatellite markers are one of the most useful techniques for molecular characterization of plant species. In the case of grapevines, six of those markers have been included in the descriptor list edition of the OIV.

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