

## MICROSATELLITE DATABASE OF GRAPEVINE (*Vitis vinifera* L.) CULTIVARS USED FOR WINE PRODUCTION IN PORTUGAL

### BASE DE DADOS DE MICROSATÉLITES DAS CASTAS (*Vitis vinifera* L.) UTILIZADAS NA PRODUÇÃO DE VINHO EM PORTUGAL

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#### SUMMARY

Six nuclear microsatellite loci (VVMD 5, VVMD 7, VVMD 27, VrZAG 62, VrZAG 79 and VVS 2) were chosen to study the differentiation of 313 grapevine cultivars officially authorized for wine production in Portugal (Portaria n° 428/2000, Diário da República n° 163, 17th July 2000). These loci were found to be highly informative and therefore constitute a useful marker set for the discrimination of the targeted cultivars. This study allowed for the detection of 244 distinct genotypes as well as for the identification of synonyms in 40 cultivars, where 2 to 6 (synonymous) cultivars represent seventeen genotypes. The remaining 29 cultivars are distributed in 11 distinct sets, where each set displays identical SSRs profiles. However, these should be considered as distinct cultivars considering that these differ in berry colour. Taken together, the results of this work will contribute to improve the management of the Portuguese Grapevine National Collection as well as give a good technical support for the update of the list of cultivars officially authorized for wine production in Portugal (Portaria n° 428/2000). Furthermore, it will also be a useful for the control of plant material in the future.

The SSR database will be available at the web page of Instituto Nacional de Recursos Biológicos (INRB) [www.inrb.pt](http://www.inrb.pt)

#### RESUMO

Trezentas e treze castas referidas na Portaria n° 428/2000 foram genotipadas usando seis loci de microsatélites nucleares (VVMD 5, VVMD 7, VVMD 27, VrZAG 62, VrZAG 79 e VVS 2). Concluiu-se que estes loci eram muito informativos, tendo permitido discriminar as cultivares estudadas. Assim, este estudo possibilitou a identificação de 244 genótipos distintos e 17 outros genótipos, cada um representado, por 2 a 6 castas (sinónimos), num total de 40 cultivares. Há ainda 29 cultivares, distribuídas por 11 grupos distintos, que embora tenham perfis de microsatélites idênticos têm a cor do bago distinta pelo que, não foram incluídas no grupo dos sinónimos.

Este trabalho contribuirá para melhorar a gestão da Coleção Ampelográfica Nacional e constituirá uma boa base de apoio técnico à alteração da lista oficial das castas usadas na produção de vinho em Portugal. É também de salientar a importância que estes resultados têm para, no futuro, apoiar o controlo da comercialização do material vegetal.

A base de dados dos microsatélites estará disponível na página web do Instituto Nacional de Recursos Biológicos (INRB) [www.inrb.pt](http://www.inrb.pt)

**Key words:** autochthonous grapevine, cultivar synonymous, Grapevine Portuguese Collection

**Palavras-Chave:** videiras autóctones, sinónfias, Coleção Ampelográfica Nacional

#### INTRODUCTION

Grapevine (*Vitis vinifera* L.) is composed of a large number of cultivars and is one of the oldest crops in the world. Grapes have been cultivated in Portugal for a long time, with evidence that *Vitis* expansion in the region now known as Portugal occurred some 5000 years ago and that the Romans played an important role in the Lusitanian viticulture, namely by the introduction of new cultivars.

Portugal still has a great diversity of autochthonous grapevine cultivars, some of them probably originating from the local wild germplasm (Cunha *et al.*, 2010). Although approximately three hundred

cultivars are officially recognized, nowadays many of them are hardly used and at risk of extinction (Almandanim *et al.*, 2007). Indeed, less than 15 native cultivars represent the majority of those presently utilised for viticulture, namely Alvarinho, Antão Vaz, Arinto, Fernão Pires, for the green yellow cultivars (25 800 ha) and Baga, Castelão, Tinta Barroca, Tinto Cão, Touriga Franca, Touriga Nacional and Trincadeira, for the blue black cultivars (73 630 ha). Others, not of Portuguese origin, like Aragonez (23 500 ha) are also of great importance.

The preservation of important genetic diversity represented by the Portuguese cultivars started in 1988

with the establishment of the Portuguese Grapevine National Collection containing approximately 720 cultivars, including all the autochthonous ones. This Collection is of great significance and imperative for ampelographic studies involving the resolution of synonyms and homonyms problems, both nationally and internationally.

The high number of cultivars utilized in Portugal and their dissemination all over the country resulted in different names being attributed to genetically identical plants (synonymous), which is a problem for viticulture and for the germplasm management.

Traditionally, cultivar characterization relied on plant morphological description (Eiras-Dias *et al.*, 1988). However, these observations are time consuming and error-prone due to environmental variations that may alter the expression of the measured characteristics.

In the last years, developments in DNA analysis for the discrimination of cultivars through the application of the microsatellite (SSR) fingerprinting in viticulture has become the technique of choice for cultivar identification and distinction (Bowers *et al.*, 1996; Sefc *et al.*, 1999). According to the OIV, SSR are the best markers to discriminate the cultivars. In fact, This *et al.*, 2004 demonstrated the usefulness of a standard set of microsatellite for identification of grape cultivars

The present study intended to complement detailed ampelographic characterization of grapevine germplasm resources by using six microsatellite loci to discriminate 313 grapevine accessions. The results allowed the identification of duplications and/or redundancies in the Collection as well as the completion of a public database.

## MATERIALS AND METHODS

### Plant material

Three hundred and thirteen accessions of *V. vinifera* ssp. *vinifera* L. from the Portuguese Grapevine National Collection (PRT 051) located at Dois Portos (Quinta da Almoíña) were analysed in this study. All these cultivars are officially authorized for wine production in Portugal (Portaria nº 428/2000, Diário da República nº 163, 17th July 2000). Although the Portaria lists 341 cultivars, 28 were not analysed because they did not integrate in the National Collection. Although most of the cultivars studied are autochthonous, some are of foreign origin.

Table I, Table II and Table III list all the accessions with the indication of their Reference in the National Collection and in the official journal, and the colour of the berry according to the OIV descriptor list for grape varieties and the *Vitis* species (blue black - N, green yellow - B, rose - Rs).

### Microsatellite analysis

DNA extraction, PCR amplification, electrophoresis and detection of polymorphisms were carried out according to Almandanim *et al.*, (2007). Six microsatellite loci recommended by the OIV, considered the minimal standard marker set for grapevine cultivar analysis (This *et al.*, 2004), VVMD 5 and VVMD 7 (Bowers *et al.*, 1996), VVMD 27 (Bowers *et al.*, 1999), VrZAG 62 and VrZAG 79 (Sefc *et al.*, 1999) and VVS 2 (Thomas and Scott, 1993), were successfully amplified. Allelic size determination was carried out through capillary electrophoresis in the CEQ8000 Genetic Analysis System (Beckman Coulter).

## RESULTS AND DISCUSSION

Three hundred and thirteen grapevine cultivars officially authorized for wine production (Tables I, II and III) were genotyped at 6 SSRs loci. Their berry colour is blue black (50%), green yellow (44%) or rose (6%). The genotyping yielded 66 alleles, ranging from 8 (VVMD 27 and VrZAG 62) to 15 (VVS2) alleles per locus. The genetic diversity found is consistent with previous studies (Lopes *et al.*, 2006, Almandanim *et al.*, 2007, Cunha *et al.*, 2010).

Table I lists 244 cultivars which, by the SSR profiles, correspond to distinct genotypes. The remaining 69 cultivars include 40 which are officially registered under different names, but that, correspond only to 17 distinct genotypes due to the presence of synonymous (Table II). In this group a single cultivar is registered under two to six distinct names as, for example, Ramisco-Tinto, Rabo-de-Ovelha-Tinto, Saborinho, Molar, Tinto-de-Porto-Santo e Tinta-Negra, which unambiguously refer to one single genotype. Sória and Sabro were also considered as synonymous, although they have one allele (VVS2) with a reproducible difference on two bases. As they have the same ampelographic characteristics, we considered this difference as a mutation. The other 29 cultivars can be distributed in 11 distinct sets, the cultivars of each set having identical SSRs profile but different berry colour (Table III). For instance, Fernão-Pires and Fernão-Pires-Rosado have the same SSR profiles but Fernão-Pires have green yellow berries while Fernão-Pires-Rosado has rose berries.

In fact, the berry colour types are indistinguishable by microsatellite analysis as already reported for some of the Portuguese cultivars (Lopes *et al.*, 1999). According to the Portuguese official legislation, cultivars with different berry colour should be considered as distinct cultivars.

Concerning the origin of the distinct cultivars described in the present work, we could arrange them in four groups: 1) autochthonous to Portugal (almost 50%); 2) hybrids obtained at Estação Agronómica Nacional by the researcher Leão Ferreira de Almeida, corresponding to 29 cultivars; 3) common to other

TABLE I

Genetic profiles, at 6 microsatellite loci, of 244 grapevines officially authorized for wine production in Portugal, for which no synonymous were detected. The cultivars are referred by the official name, the reference number at Coleção Ampelográfica Nacional and the Portaria number. Allele size is given in base pairs. B, N and Rs correspond to green yellow, blue black and rose colour of the berry, respectively

*Tamanho dos alelos para seis loci de microssatélites de 244 castas oficialmente autorizadas para a produção de vinho em Portugal. As castas são referidas pelo nome oficial, referência na Coleção Ampelográfica Nacional e na Portaria nº 428/2000. B, N e Rs correspondem a castas brancas, tintas e rosadas, respectivamente*

| Cultivar Name         | Collection Reference | Portaria Number | VVMD 5   |          | VVMD 7   |          | VVMD 27  |          | VrZAG 62 |          | VrZAG 79 |          | VVS 2    |          |
|-----------------------|----------------------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                       |                      |                 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 |
| Agronómica N          | 41505                | 1               | 236      | 238      | 239      | 243      | 179      | 185      | 188      | 192      | 239      | 251      | 137      | 145      |
| Agua Santa N          | 50615                | 2               | 238      | 238      | 239      | 249      | 179      | 189      | 188      | 200      | 251      | 251      | 147      | 147      |
| Alcoa N               | 41504                | 3               | 226      | 238      | 235      | 253      | 181      | 181      | 188      | 188      | 243      | 247      | 141      | 145      |
| Alicante-Bouschet N   | 53808                | 5               | 226      | 238      | 235      | 239      | 181      | 194      | 188      | 188      | 243      | 257      | 135      | 147      |
| Alicante-Branco B     | 50711                | 6               | 228      | 240      | 235      | 239      | 179      | 194      | 186      | 188      | 251      | 257      | 145      | 147      |
| Almafra B             | 52313                | 7               | 222      | 226      | 235      | 245      | 179      | 181      | 188      | 204      | 247      | 251      | 139      | 147      |
| Alvadurão B           | 52114                | 9               | 222      | 236      | 235      | 245      | 181      | 181      | 194      | 204      | 247      | 247      | 139      | 153      |
| Alvarelhão N          | 53207                | 12              | 222      | 226      | 235      | 235      | 185      | 189      | 188      | 194      | 251      | 259      | 135      | 153      |
| Alvarelhao-Ceitão N   | 41209                | 14              | 226      | 240      | 235      | 239      | 189      | 194      | 188      | 188      | 251      | 257      | 145      | 153      |
| Alvarinho B           | 52007                | 15              | 222      | 232      | 235      | 235      | 189      | 189      | 186      | 204      | 247      | 251      | 137      | 153      |
| Amor-Nao-Me-Deixes N  | 51003                | 17              | 234      | 234      | 235      | 239      | 181      | 194      | 188      | 196      | 243      | 257      | 135      | 145      |
| Amostrinha N          | 53204                | 18              | 234      | 238      | 239      | 253      | 181      | 189      | 188      | 188      | 247      | 251      | 145      | 147      |
| Antão-Vaz B           | 52316                | 19              | 234      | 236      | 245      | 259      | 181      | 183      | 204      | 204      | 247      | 247      | 147      | 153      |
| Aragonez N            | 52603                | 20              | 236      | 236      | 235      | 249      | 183      | 183      | 196      | 200      | 247      | 251      | 145      | 147      |
| Aramon N              | 53704                | 21              | 226      | 226      | 243      | 245      | 179      | 181      | 204      | 204      | 251      | 259      | 135      | 135      |
| Arinto B              | 52311                | 22              | 226      | 238      | 239      | 247      | 181      | 185      | 186      | 188      | 247      | 251      | 145      | 153      |
| Arinto-do-Interior B  | 51412                | 23              | 222      | 240      | 235      | 235      | 183      | 194      | 186      | 188      | 247      | 247      | 145      | 153      |
| Arjunção N            | 52104                | 25              | 228      | 240      | 235      | 245      | 185      | 189      | 194      | 196      | 243      | 251      | 153      | 159      |
| Arnsburger B          | 40602                | 26              | 226      | 236      | 243      | 243      | 181      | 189      | 194      | 204      | 243      | 259      | 135      | 145      |
| Assaraky B            | 40404                | 27              | 222      | 226      | 235      | 235      | 183      | 185      | 186      | 188      | 243      | 247      | 135      | 137      |
| Avesso B              | 52310                | 28              | 222      | 240      | 235      | 235      | 181      | 189      | 186      | 186      | 243      | 247      | 137      | 153      |
| Azal B                | 52809                | 29              | 226      | 232      | 235      | 243      | 181      | 185      | 194      | 204      | 247      | 251      | 153      | 159      |
| Babosa B              | 40603                | 30              | 226      | 240      | 243      | 249      | 179      | 181      | 188      | 202      | 243      | 247      | 145      | 147      |
| Baga N                | 52606                | 31              | 232      | 240      | 235      | 235      | 179      | 189      | 188      | 204      | 247      | 251      | 145      | 157      |
| Barca N               | 52101                | 32              | 226      | 232      | 235      | 235      | 183      | 189      | 188      | 188      | 245      | 257      | 145      | 153      |
| Barcelo B             | 52407                | 33              | 226      | 232      | 235      | 259      | 181      | 189      | 194      | 196      | 245      | 247      | 137      | 153      |
| Bastardo-Branco B     | 51117                | 36              | 226      | 238      | 253      | 253      | 175      | 189      | 188      | 188      | 247      | 251      | 145      | 153      |
| Batoça B              | 52507                | 39              | 226      | 226      | 243      | 247      | 183      | 185      | 186      | 204      | 247      | 251      | 145      | 153      |
| Beba B                | 51808                | 40              | 236      | 240      | 239      | 245      | 179      | 189      | 188      | 204      | 243      | 247      | 137      | 145      |
| Bical B               | 52016                | 41              | 226      | 240      | 235      | 259      | 179      | 185      | 188      | 194      | 251      | 251      | 135      | 147      |
| Boal-Branco B         | 52116                | 43              | 238      | 240      | 249      | 253      | 179      | 185      | 188      | 188      | 251      | 251      | 141      | 145      |
| Boal-Espinho B        | 52017                | 44              | 226      | 234      | 235      | 239      | 179      | 194      | 188      | 188      | 253      | 257      | 145      | 147      |
| Bonedro N             | 41601                | 45              | 226      | 240      | 239      | 249      | 181      | 181      | 194      | 200      | 247      | 251      | 145      | 147      |
| Borraçal N            | 52807                | 46              | 232      | 238      | 235      | 235      | 181      | 185      | 194      | 194      | 247      | 247      | 135      | 137      |
| Branca-de-Anadia B    | 50314                | 48              | 226      | 238      | 235      | 249      | 183      | 185      | 188      | 188      | 247      | 257      | 147      | 153      |
| Branco-Desconhecido B | 41107                | 49              | 226      | 240      | 235      | 245      | 181      | 194      | 196      | 204      | 249      | 259      | 135      | 137      |
| Branco-Especial B     | 51216                | 50              | 228      | 236      | 239      | 243      | 181      | 189      | 188      | 194      | 245      | 259      | 153      | 157      |
| Branco-Guimarães B    | 51018                | 52              | 226      | 232      | 235      | 235      | 185      | 185      | 186      | 186      | 243      | 251      | 135      | 159      |
| Branda B              | 52117                | 54              | 226      | 226      | 235      | 253      | 183      | 189      | 188      | 194      | 247      | 251      | 135      | 145      |
| Branjo N              | 41202                | 55              | 226      | 226      | 259      | 259      | 183      | 189      | 188      | 194      | 245      | 247      | 145      | 159      |
| Cabernet-Franc N      | 50801                | 57              | 226      | 240      | 237      | 261      | 181      | 189      | 194      | 204      | 247      | 259      | 141      | 149      |
| Cabinda N             | 53103                | 58              | 226      | 236      | 235      | 253      | 179      | 181      | 188      | 188      | 243      | 251      | 147      | 153      |
| Cabernet-Sauvignon N  | 53606                | 58              | 232      | 240      | 235      | 235      | 181      | 189      | 188      | 194      | 247      | 247      | 141      | 153      |
| Caladoc N             | 50102                | 61              | 224      | 236      | 235      | 235      | 191      | 194      | 188      | 188      | 257      | 259      | 147      | 153      |
| Camarate N            | 52402                | 63              | 234      | 236      | 239      | 249      | 181      | 189      | 188      | 200      | 247      | 251      | 147      | 153      |
| Campanário N          | 41806                | 64              | 226      | 238      | 235      | 253      | 181      | 183      | 188      | 194      | 245      | 247      | 147      | 153      |
| Caracol B             | 50914                | 65              | 240      | 240      | 235      | 243      | 179      | 194      | 188      | 196      | 247      | 257      | 135      | 147      |
| Caramela B            | 51016                | 66              | 228      | 236      | 243      | 243      | 185      | 185      | 192      | 194      | 239      | 251      | 137      | 147      |
| Carignan N            | 53804                | 68              | 226      | 228      | 235      | 235      | 181      | 185      | 186      | 188      | 251      | 259      | 145      | 147      |
| Carrasquenho B        | 52605                | 69              | 222      | 226      | 235      | 253      | 179      | 189      | 188      | 188      | 251      | 261      | 135      | 147      |
| Carrega-Branco B      | 51816                | 70              | 234      | 236      | 239      | 253      | 181      | 189      | 188      | 194      | 245      | 247      | 139      | 153      |
| Carrega-Burros N      | 52902                | 71              | 228      | 234      | 235      | 239      | 181      | 185      | 188      | 188      | 247      | 251      | 139      | 145      |
| Cascal B              | 51517                | 73              | 222      | 226      | 235      | 243      | 181      | 181      | 186      | 204      | 247      | 247      | 153      | 153      |
| Casculho N            | 50901                | 74              | 236      | 238      | 245      | 249      | 181      | 189      | 200      | 204      | 247      | 251      | 147      | 153      |
| Castalia B            | 40702                | 75              | 228      | 238      | 245      | 249      | 185      | 194      | 188      | 196      | 247      | 257      | 145      | 151      |
| Castelã N             | 51002                | 76              | 236      | 238      | 245      | 253      | 181      | 181      | 188      | 204      | 247      | 251      | 139      | 153      |
| Castelão N            | 53106                | 77              | 236      | 238      | 239      | 253      | 179      | 181      | 188      | 188      | 247      | 251      | 145      | 147      |
| Castelão-Branco B     | 52615                | 78              | 226      | 240      | 235      | 253      | 181      | 189      | 188      | 188      | 247      | 251      | 145      | 153      |
| Castelino N           | 52706                | 79              | 232      | 232      | 249      | 253      | 179      | 194      | 194      | 200      | 243      | 257      | 135      | 135      |
| Castelo- Branco B     | 50309                | 80              | 238      | 240      | 235      | 249      | 181      | 183      | 188      | 194      | 247      | 247      | 145      | 147      |
| Casteloa N            | 41303                | 81              | 234      | 238      | 245      | 249      | 181      | 189      | 200      | 204      | 247      | 251      | 139      | 145      |
| Cerceal-Branco B      | 52410                | 82              | 226      | 236      | 245      | 253      | 179      | 181      | 188      | 204      | 247      | 251      | 145      | 159      |
| Cercial B             | 52412                | 83              | 226      | 240      | 251      | 255      | 179      | 185      | 188      | 188      | 251      | 259      | 147      | 153      |

| Cultivar Name                  | Collection Reference | Portaria Number | VVMD 5   |          | VVMD 7   |          | VVMD 27  |          | VrZAG 62 |          | VrZAG 79 |          | VVS 2    |          |
|--------------------------------|----------------------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                                |                      |                 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 |
| Chardonnay B                   | 53511                | 84              | 234      | 238      | 235      | 239      | 181      | 189      | 188      | 196      | 243      | 245      | 139      | 145      |
| Chenin B                       | 53512                | 89              | 228      | 232      | 235      | 253      | 175      | 189      | 188      | 194      | 247      | 251      | 135      | 153      |
| Cidadelhe N                    | 51308                | 90              | 232      | 234      | 239      | 249      | 181      | 194      | 192      | 200      | 247      | 257      | 145      | 145      |
| Cidreiro N                     | 51404                | 91              | 226      | 232      | 235      | 249      | 181      | 181      | 188      | 200      | 247      | 259      | 153      | 153      |
| Códega-de-Larinho B            | 51317                | 93              | 222      | 240      | 235      | 239      | 189      | 194      | 186      | 188      | 243      | 257      | 135      | 147      |
| Colombard B                    | 50114                | 94              | 232      | 240      | 235      | 235      | 175      | 181      | 182      | 184      | 243      | 247      | 145      | 153      |
| Complexa N                     | 50201                | 95              | 226      | 238      | 235      | 245      | 185      | 194      | 186      | 188      | 239      | 257      | 147      | 151      |
| Conceira N                     | 50902                | 96              | 238      | 238      | 235      | 249      | 181      | 181      | 188      | 200      | 247      | 251      | 135      | 153      |
| Coração-de-Galo N              | 51304                | 97              | 226      | 232      | 235      | 235      | 181      | 189      | 188      | 194      | 245      | 247      | 135      | 145      |
| Cornichon B                    | 40708                | 98              | 236      | 246      | 243      | 245      | 179      | 181      | 196      | 204      | 251      | 251      | 147      | 151      |
| Cornifesto N                   | 52004                | 99              | 234      | 238      | 245      | 249      | 181      | 189      | 200      | 204      | 247      | 251      | 145      | 147      |
| Corropio N                     | 51405                | 100             | 228      | 238      | 235      | 249      | 185      | 194      | 186      | 188      | 247      | 257      | 135      | 135      |
| Corvo N                        | 51207                | 102             | 232      | 236      | 249      | 253      | 179      | 194      | 194      | 200      | 251      | 251      | 129      | 135      |
| Dedo-de-Dama B                 | 51209                | 104             | 236      | 236      | 243      | 245      | 179      | 181      | 196      | 204      | 251      | 251      | 147      | 151      |
| Deliciosa N                    | 41707                | 105             | 226      | 238      | 235      | 249      | 181      | 185      | 188      | 188      | 243      | 257      | 145      | 147      |
| Diagalves B                    | 52513                | 106             | 236      | 240      | 239      | 249      | 181      | 185      | 188      | 188      | 247      | 247      | 145      | 153      |
| Doçal N                        | 50904                | 107             | 226      | 238      | 243      | 259      | 183      | 194      | 186      | 194      | 247      | 251      | 145      | 153      |
| Doce N                         | 50905                | 108             | 226      | 226      | 247      | 259      | 183      | 189      | 186      | 194      | 247      | 247      | 135      | 145      |
| Dona-Joaquina B                | 51609                | 110             | 226      | 232      | 235      | 245      | 179      | 194      | 186      | 188      | 247      | 251      | 135      | 153      |
| Donzelinho-Branco B            | 52307                | 111             | 232      | 238      | 239      | 259      | 189      | 189      | 188      | 194      | 251      | 251      | 141      | 153      |
| Donzelinho-Roxo Rs             | 41709                | 112             | 228      | 238      | 235      | 239      | 189      | 194      | 186      | 192      | 251      | 257      | 145      | 153      |
| Donzelinho-Tinto N             | 52306                | 113             | 226      | 232      | 239      | 259      | 181      | 189      | 194      | 194      | 251      | 251      | 153      | 153      |
| Dorinto B                      | 51411                | 114             | 238      | 240      | 235      | 253      | 181      | 189      | 188      | 194      | 247      | 251      | 137      | 153      |
| Encruzado B                    | 52207                | 115             | 226      | 232      | 235      | 253      | 183      | 189      | 194      | 194      | 247      | 251      | 151      | 153      |
| Engomada N                     | 51008                | 116             | 232      | 238      | 235      | 235      | 181      | 194      | 188      | 188      | 247      | 257      | 145      | 145      |
| Esganinho B                    | 41103                | 118             | 232      | 238      | 235      | 259      | 181      | 189      | 188      | 194      | 245      | 247      | 141      | 153      |
| Esganoso N                     | 50915                | 119             | 226      | 236      | 235      | 235      | 181      | 181      | 188      | 194      | 239      | 247      | 135      | 153      |
| Espadeiro N                    | 52904                | 120             | 222      | 226      | 243      | 259      | 183      | 189      | 196      | 204      | 251      | 251      | 135      | 153      |
| Espadeiro-Mole N               | 51604                | 121             | 236      | 240      | 235      | 245      | 189      | 189      | 194      | 200      | 251      | 251      | 135      | 157      |
| Estreito-Macio B               | 51017                | 122             | 222      | 236      | 235      | 239      | 181      | 189      | 188      | 196      | 247      | 251      | 135      | 147      |
| Fepiro N                       | 41502                | 124             | 226      | 226      | 235      | 239      | 181      | 194      | 188      | 188      | 243      | 247      | 141      | 153      |
| Ferral N                       | 50104                | 127             | 232      | 238      | 235      | 245      | 183      | 194      | 192      | 204      | 247      | 257      | 137      | 149      |
| Fontecal B                     | 52314                | 131             | 226      | 234      | 235      | 235      | 183      | 185      | 186      | 186      | 247      | 251      | 135      | 153      |
| Galego N                       | 41203                | 132             | 228      | 232      | 239      | 251      | 185      | 189      | 200      | 204      | 239      | 251      | 133      | 141      |
| Galego-Dourado B               | 52913                | 133             | 228      | 240      | 235      | 239      | 185      | 189      | 188      | 194      | 245      | 251      | 135      | 135      |
| Gamay N                        | 53906                | 135             | 234      | 238      | 235      | 245      | 181      | 189      | 194      | 204      | 243      | 245      | 135      | 139      |
| Generosa B                     | 40808                | 136             | 226      | 228      | 235      | 235      | 194      | 194      | 186      | 194      | 247      | 247      | 147      | 153      |
| Gewurztraminer Rs              | 53904                | 137             | 232      | 238      | 239      | 253      | 189      | 189      | 188      | 194      | 245      | 251      | 153      | 153      |
| Goncalo-Pires N                | 50802                | 140             | 226      | 236      | 235      | 239      | 181      | 181      | 188      | 196      | 247      | 259      | 135      | 145      |
| Gorda N                        | 50607                | 141             | 234      | 238      | 245      | 253      | 181      | 189      | 188      | 204      | 247      | 251      | 139      | 153      |
| Gouveio-Estimado B             | 50617                | 143             | 226      | 234      | 239      | 245      | 181      | 189      | 188      | 204      | 247      | 251      | 139      | 153      |
| Gouveio-Preto N                | 41305                | 144             | 236      | 238      | 235      | 235      | 183      | 189      | 186      | 196      | 245      | 251      | 145      | 153      |
| Gouveio-Real B                 | 50616                | 145             | 226      | 234      | 235      | 239      | 181      | 189      | 188      | 204      | 247      | 251      | 145      | 153      |
| Grand-Noir N                   | 50804                | 148             | 226      | 234      | 235      | 239      | 181      | 183      | 188      | 188      | 243      | 259      | 141      | 153      |
| Grangeal N                     | 51602                | 149             | 226      | 236      | 235      | 235      | 181      | 189      | 186      | 194      | 247      | 261      | 153      | 153      |
| Granho B                       | 40606                | 150             | 236      | 240      | 235      | 239      | 181      | 194      | 188      | 194      | 247      | 247      | 139      | 147      |
| Grenache N                     | 53406                | 151             | 226      | 240      | 235      | 239      | 194      | 194      | 188      | 188      | 257      | 257      | 139      | 147      |
| Jacquere B                     | 40806                | 153             | 226      | 234      | 235      | 245      | 179      | 181      | 196      | 204      | 243      | 251      | 135      | 145      |
| Jaen N                         | 52503                | 154             | 226      | 236      | 245      | 253      | 181      | 189      | 188      | 194      | 247      | 251      | 147      | 153      |
| Labrusco N                     | 41204                | 156             | 226      | 238      | 245      | 259      | 181      | 185      | 194      | 200      | 243      | 247      | 153      | 157      |
| Lameiro B                      | 50611                | 157             | 230      | 232      | 235      | 235      | 181      | 185      | 188      | 194      | 247      | 251      | 135      | 159      |
| Larião B                       | 51113                | 158             | 238      | 240      | 235      | 235      | 181      | 194      | 188      | 192      | 257      | 257      | 147      | 149      |
| Lilás B                        | 40701                | 160             | 232      | 238      | 235      | 239      | 185      | 194      | 188      | 196      | 251      | 257      | 153      | 153      |
| Listrão Rs                     | 41605                | 161             | 228      | 240      | 235      | 245      | 185      | 189      | 194      | 196      | 243      | 251      | 135      | 137      |
| Loureiro B                     | 52213                | 161             | 232      | 232      | 247      | 259      | 181      | 185      | 186      | 196      | 251      | 251      | 145      | 153      |
| Lourela N                      | 50708                | 163             | 232      | 240      | 239      | 259      | 181      | 189      | 188      | 194      | 247      | 247      | 141      | 145      |
| Lusitano N                     | 41503                | 164             | 238      | 238      | 235      | 253      | 181      | 194      | 188      | 188      | 247      | 257      | 145      | 147      |
| Luzidio B                      | 51115                | 165             | 226      | 232      | 235      | 235      | 181      | 189      | 188      | 204      | 245      | 247      | 145      | 153      |
| Malandra N                     | 50608                | 166             | 226      | 240      | 235      | 249      | 179      | 181      | 188      | 200      | 261      | 261      | 145      | 153      |
| Malvarisco N                   | 53308                | 167             | 226      | 232      | 249      | 259      | 185      | 189      | 188      | 200      | 251      | 251      | 135      | 153      |
| Malvasia B                     | 52714                | 168             | 232      | 234      | 235      | 235      | 181      | 181      | 188      | 194      | 247      | 257      | 145      | 147      |
| Malvasia-Bianca B              | 51009                | 169             | 226      | 238      | 245      | 259      | 185      | 185      | 200      | 202      | 239      | 251      | 135      | 145      |
| Malvasia-Branca B              | 50912                | 170             | 226      | 238      | 239      | 245      | 179      | 179      | 188      | 200      | 255      | 257      | 135      | 139      |
| Malvasia-Branca-de-São-Jorge B | 40604                | 171             | 222      | 226      | 235      | 235      | 181      | 194      | 188      | 196      | 247      | 251      | 135      | 147      |
| Malvasia-Cabral Rs             | 51212                | 172             | 222      | 240      | 235      | 245      | 183      | 189      | 188      | 204      | 247      | 251      | 139      | 153      |
| Malvasia-Rei B                 | 53013                | 179             | 228      | 240      | 235      | 245      | 185      | 194      | 188      | 194      | 251      | 257      | 135      | 147      |
| Malvoeira B                    | 40704                | 182             | 226      | 238      | 235      | 239      | 185      | 194      | 188      | 204      | 247      | 257      | 145      | 147      |
| Manteúdo B                     | 51413                | 183             | 222      | 226      | 235      | 245      | 181      | 181      | 188      | 194      | 237      | 259      | 145      | 145      |
| Mateúdo-Preto N                | 41603                | 184             | 228      | 234      | 249      | 249      | 181      | 189      | 194      | 204      | 243      | 247      | 133      | 145      |
| Marquinhas B                   | 53312                | 186             | 226      | 228      | 235      | 235      | 194      | 194      | 188      | 188      | 247      | 247      | 153      | 153      |
| Melra N                        | 41309                | 189             | 228      | 236      | 235      | 235      | 181      | 194      | 188      | 188      | 245      | 257      | 147      | 153      |
| Merlot N                       | 50518                | 190             | 226      | 236      | 235      | 243      | 189      | 191      | 194      | 194      | 259      | 259      | 141      | 153      |
| Mindelo N                      | 41607                | 191             | 238      | 238      | 235      | 245      | 179      | 185      | 186      | 188      | 247      | 247      | 137      | 147      |

| Cultivar Name           | Collection Reference | Portaria Number | VVMD 5   |          | VVMD 7   |          | VVMD 27  |          | VrZAG 62 |          | VrZAG 79 |          | VVS 2    |          |
|-------------------------|----------------------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                         |                      |                 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 |
| Mondet N                | 50702                | 194             | 232      | 232      | 235      | 247      | 179      | 191      | 194      | 200      | 251      | 251      | 135      | 153      |
| Monvedro N              | 51804                | 195             | 226      | 226      | 235      | 249      | 179      | 189      | 188      | 200      | 245      | 251      | 153      | 153      |
| Moreto N                | 52301                | 196             | 226      | 236      | 239      | 253      | 181      | 189      | 188      | 188      | 247      | 251      | 147      | 153      |
| Moscadet B              | 51417                | 197             | 232      | 234      | 235      | 235      | 175      | 179      | 188      | 196      | 237      | 247      | 135      | 135      |
| Moscargo N              | 41508                | 198             | 238      | 238      | 243      | 253      | 179      | 179      | 188      | 192      | 251      | 255      | 145      | 151      |
| Moscatel-Galego-Tinto N | 41301                | 201             | 226      | 228      | 235      | 245      | 179      | 189      | 186      | 188      | 251      | 255      | 135      | 153      |
| Moscatel-Graúdo B       | 40705                | 202             | 228      | 232      | 245      | 247      | 179      | 194      | 186      | 204      | 247      | 255      | 135      | 151      |
| Moscatel-Nunes B        | 53015                | 203             | 232      | 234      | 235      | 245      | 179      | 194      | 186      | 188      | 255      | 257      | 135      | 147      |
| Mourisco N              | 51701                | 204             | 226      | 226      | 259      | 259      | 181      | 189      | 194      | 196      | 247      | 259      | 137      | 157      |
| Mourisco-Branco B       | 50916                | 205             | 234      | 240      | 235      | 239      | 181      | 194      | 188      | 188      | 247      | 257      | 145      | 147      |
| Mourisco-de-Semente N   | 51402                | 206             | 232      | 238      | 235      | 235      | 181      | 194      | 188      | 194      | 247      | 257      | 137      | 145      |
| Mourisco-de-Trevões N   | 41306                | 207             | 232      | 238      | 235      | 247      | 194      | 194      | 188      | 200      | 257      | 257      | 135      | 147      |
| Mulata N                | 53407                | 209             | 226      | 236      | 235      | 253      | 179      | 181      | 188      | 188      | 243      | 251      | 147      | 147      |
| Muller-Thurgau B        | 53313                | 210             | 226      | 228      | 243      | 253      | 181      | 181      | 194      | 194      | 243      | 245      | 145      | 153      |
| Naia B                  | 40703                | 211             | 234      | 240      | 235      | 235      | 185      | 194      | 188      | 204      | 251      | 253      | 137      | 147      |
| Negra-Mole N            | 52202                | 212             | 222      | 240      | 235      | 235      | 181      | 181      | 188      | 196      | 247      | 259      | 145      | 159      |
| Nevoeira N              | 52005                | 213             | 232      | 236      | 235      | 253      | 179      | 189      | 186      | 194      | 247      | 247      | 153      | 159      |
| Padeiro N               | 50806                | 214             | 226      | 234      | 235      | 235      | 189      | 194      | 188      | 188      | 251      | 257      | 137      | 147      |
| Parreira-Matias N       | 52702                | 215             | 224      | 224      | 249      | 253      | 179      | 181      | 188      | 200      | 251      | 259      | 145      | 153      |
| Patorra N               | 52006                | 216             | 236      | 240      | 235      | 245      | 181      | 189      | 188      | 194      | 243      | 247      | 135      | 147      |
| Pé-Comprido B           | 41002                | 218             | 226      | 226      | 235      | 235      | 185      | 189      | 186      | 196      | 245      | 251      | 135      | 135      |
| Pedral N                | 52105                | 219             | 226      | 226      | 235      | 259      | 181      | 185      | 186      | 196      | 247      | 251      | 153      | 159      |
| Perrum B                | 51617                | 222             | 236      | 240      | 235      | 239      | 181      | 185      | 188      | 188      | 243      | 247      | 135      | 147      |
| Petit-Bouschet N        | 51206                | 223             | 234      | 238      | 235      | 239      | 181      | 189      | 188      | 196      | 245      | 247      | 135      | 153      |
| Pical N                 | 51007                | 226             | 226      | 232      | 235      | 239      | 179      | 189      | 188      | 188      | 251      | 251      | 135      | 135      |
| Pilongo N               | 51606                | 227             | 238      | 240      | 235      | 253      | 179      | 185      | 186      | 194      | 247      | 247      | 135      | 145      |
| Pintosa B               | 51217                | 233             | 226      | 232      | 239      | 247      | 179      | 185      | 186      | 188      | 251      | 251      | 145      | 153      |
| Portugues-Azul N        | 50605                | 234             | 226      | 232      | 239      | 251      | 181      | 194      | 188      | 204      | 249      | 259      | 145      | 153      |
| Praça B                 | 51715                | 235             | 226      | 232      | 235      | 235      | 185      | 189      | 186      | 186      | 251      | 251      | 135      | 159      |
| Preto-Cardana N         | 52705                | 236             | 232      | 236      | 245      | 253      | 181      | 181      | 188      | 194      | 245      | 247      | 139      | 153      |
| Preto-Martinho N        | 51803                | 237             | 232      | 238      | 235      | 249      | 179      | 183      | 188      | 200      | 247      | 251      | 145      | 147      |
| Primavera N             | 53102                | 238             | 226      | 236      | 239      | 239      | 181      | 181      | 188      | 188      | 243      | 247      | 147      | 147      |
| Promissão B             | 40501                | 239             | 234      | 236      | 229      | 239      | 179      | 185      | 188      | 196      | 239      | 249      | 135      | 145      |
| Rabigato B              | 52014                | 240             | 222      | 232      | 235      | 235      | 185      | 189      | 186      | 196      | 243      | 251      | 135      | 135      |
| Rabigato-Franco B       | 51613                | 241             | 228      | 236      | 243      | 249      | 185      | 185      | 188      | 194      | 239      | 251      | 135      | 145      |
| Rabigato-Moreno B       | 50917                | 242             | 232      | 234      | 235      | 235      | 185      | 194      | 186      | 188      | 237      | 247      | 135      | 145      |
| Rabo-de-Anho N          | 52903                | 243             | 222      | 226      | 235      | 259      | 181      | 185      | 186      | 196      | 247      | 251      | 137      | 159      |
| Rabo-de-Ovelha B        | 52011                | 245             | 222      | 236      | 235      | 239      | 181      | 181      | 188      | 194      | 247      | 247      | 139      | 153      |
| Ramisco N               | 52203                | 247             | 226      | 238      | 235      | 259      | 181      | 185      | 188      | 196      | 247      | 251      | 135      | 159      |
| Ratinho B               | 52309                | 249             | 222      | 240      | 245      | 253      | 181      | 194      | 188      | 204      | 247      | 247      | 139      | 147      |
| Ricoa N                 | 51103                | 250             | 232      | 238      | 235      | 239      | 183      | 189      | 188      | 192      | 245      | 247      | 145      | 145      |
| Riesling B              | 53209                | 251             | 226      | 234      | 245      | 253      | 181      | 189      | 194      | 204      | 243      | 245      | 145      | 153      |
| Rio-Grande B            | 40809                | 252             | 238      | 240      | 235      | 239      | 181      | 183      | 188      | 188      | 247      | 247      | 145      | 153      |
| Roal Rs                 | 53806                | 253             | 234      | 236      | 245      | 249      | 181      | 183      | 188      | 204      | 247      | 247      | 139      | 145      |
| Rodo N                  | 51708                | 254             | 226      | 232      | 235      | 257      | 189      | 189      | 194      | 194      | 245      | 259      | 135      | 141      |
| Roseira N               | 50707                | 255             | 226      | 232      | 235      | 249      | 181      | 194      | 188      | 200      | 247      | 257      | 145      | 145      |
| Roupeiro-Branco B       | 51314                | 256             | 240      | 240      | 235      | 243      | 185      | 194      | 188      | 204      | 245      | 257      | 145      | 153      |
| Roxo-Flor Rs            | 41705                | 257             | 226      | 232      | 239      | 239      | 185      | 194      | 188      | 188      | 251      | 257      | 145      | 153      |
| Roxo-Rei Rs             | 50919                | 258             | 226      | 228      | 235      | 235      | 183      | 185      | 188      | 188      | 247      | 259      | 135      | 145      |
| Rufete N                | 52106                | 259             | 226      | 236      | 235      | 253      | 181      | 189      | 188      | 194      | 245      | 247      | 135      | 159      |
| Santareno N             | 52304                | 263             | 228      | 234      | 235      | 239      | 179      | 189      | 188      | 194      | 251      | 255      | 135      | 153      |
| São-Mamede B            | 51611                | 265             | 230      | 236      | 235      | 245      | 185      | 189      | 188      | 200      | 251      | 251      | 135      | 157      |
| Sarigo B                | 51316                | 267             | 234      | 236      | 239      | 245      | 181      | 181      | 188      | 204      | 247      | 247      | 139      | 147      |
| Sauvignon B             | 53211                | 268             | 228      | 232      | 235      | 253      | 175      | 189      | 188      | 194      | 245      | 247      | 135      | 153      |
| Seara-Nova B            | 40403                | 269             | 238      | 240      | 235      | 239      | 181      | 183      | 188      | 194      | 247      | 247      | 145      | 147      |
| Semilão B               | 50809                | 270             | 232      | 240      | 235      | 235      | 175      | 181      | 188      | 196      | 243      | 247      | 145      | 153      |
| Semillon B              | 53212                | 271             | 236      | 238      | 235      | 253      | 175      | 185      | 188      | 194      | 247      | 247      | 135      | 135      |
| Sercial B               | 40505                | 272             | 226      | 238      | 235      | 249      | 181      | 185      | 188      | 194      | 247      | 259      | 135      | 153      |
| Sercialinho B           | 51011                | 273             | 226      | 240      | 235      | 235      | 181      | 194      | 188      | 188      | 247      | 251      | 147      | 153      |
| Sevilhão N              | 51403                | 274             | 228      | 238      | 245      | 259      | 189      | 189      | 194      | 200      | 251      | 259      | 153      | 153      |
| Sousão N                | 51901                | 276             | 222      | 226      | 235      | 235      | 185      | 189      | 194      | 196      | 245      | 251      | 137      | 153      |
| Syrah N                 | 41407                | 277             | 226      | 232      | 235      | 235      | 189      | 191      | 188      | 194      | 245      | 251      | 135      | 135      |
| Tália B                 | 52910                | 278             | 226      | 232      | 245      | 249      | 179      | 183      | 194      | 200      | 245      | 251      | 135      | 145      |
| Tannat N                | 41609                | 280             | 238      | 240      | 245      | 245      | 185      | 189      | 194      | 200      | 239      | 251      | 145      | 157      |
| Teinturier N            | 53807                | 281             | 226      | 236      | 235      | 235      | 181      | 185      | 188      | 196      | 245      | 253      | 147      | 153      |
| Terrantéz B             | 52210                | 282             | 226      | 238      | 243      | 259      | 185      | 189      | 194      | 196      | 251      | 251      | 145      | 159      |
| Terrantéz-da-Terceira B | 50218                | 283             | 222      | 226      | 235      | 253      | 179      | 189      | 188      | 194      | 251      | 251      | 147      | 153      |
| Terrantéz-do-Pico B     | 50216                | 284             | 232      | 238      | 235      | 235      | 175      | 189      | 188      | 196      | 247      | 251      | 145      | 153      |
| Tinta-Aguiar N          | 50703                | 286             | 226      | 232      | 235      | 239      | 189      | 194      | 192      | 194      | 245      | 257      | 145      | 147      |
| Tinta-Aurélio B         | 40609                | 287             | 232      | 238      | 235      | 253      | 189      | 194      | 188      | 200      | 251      | 257      | 147      | 153      |
| Tinta-Barroca N         | 52905                | 288             | 228      | 236      | 235      | 239      | 181      | 183      | 188      | 192      | 245      | 247      | 145      | 153      |
| Tinta-Carvalha N        | 52201                | 291             | 232      | 236      | 245      | 259      | 181      | 189      | 194      | 204      | 247      | 251      | 147      | 153      |
| Tinta-Fontes N          | 50706                | 292             | 226      | 238      | 235      | 247      | 181      | 189      | 186      | 188      | 245      | 247      | 153      | 153      |

| Cultivar Name            | Collection Reference | Portaria Number | VVMD 5   |          | VVMD 7   |          | VVMD 27  |          | VrZAG 62 |          | VrZAG 79 |          | VVS 2    |          |
|--------------------------|----------------------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                          |                      |                 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 |
| Tinta-Francisca N        | 52502                | 293             | 238      | 238      | 235      | 235      | 185      | 189      | 186      | 188      | 243      | 247      | 135      | 135      |
| Tinta-Martins N          | 50602                | 296             | 232      | 238      | 235      | 239      | 183      | 194      | 188      | 192      | 257      | 259      | 147      | 155      |
| Tinta-Mesquita N         | 50604                | 297             | 226      | 232      | 235      | 259      | 189      | 194      | 188      | 196      | 245      | 257      | 135      | 147      |
| Tinta-Miúda N            | 51906                | 298             | 226      | 238      | 235      | 235      | 179      | 183      | 186      | 188      | 251      | 259      | 141      | 153      |
| Tinta-Penajoia N         | 51208                | 300             | 226      | 232      | 247      | 253      | 179      | 189      | 194      | 200      | 247      | 251      | 135      | 153      |
| Tinta-Pereira N          | 50907                | 301             | 232      | 236      | 235      | 245      | 181      | 185      | 188      | 204      | 247      | 259      | 147      | 159      |
| Tinta-Pomar N            | 50807                | 302             | 238      | 238      | 247      | 253      | 189      | 194      | 200      | 200      | 251      | 257      | 137      | 153      |
| Tinta-Tabuaço N          | 51307                | 304             | 236      | 238      | 235      | 253      | 175      | 183      | 186      | 188      | 247      | 251      | 145      | 159      |
| Tintem N                 | 52505                | 305             | 238      | 238      | 235      | 253      | 181      | 181      | 188      | 188      | 247      | 257      | 135      | 145      |
| Tintinha N               | 51205                | 306             | 234      | 238      | 239      | 253      | 181      | 181      | 188      | 188      | 243      | 247      | 135      | 147      |
| Tinto-Cão N              | 53307                | 307             | 232      | 234      | 235      | 259      | 181      | 185      | 186      | 194      | 247      | 251      | 135      | 135      |
| Tinto-Pegões N           | 52506                | 308             | 236      | 238      | 235      | 239      | 181      | 181      | 188      | 188      | 243      | 247      | 135      | 147      |
| Touriga-Fêmea N          | 50705                | 311             | 236      | 240      | 235      | 253      | 179      | 189      | 188      | 194      | 245      | 251      | 145      | 145      |
| Touriga-Franca N         | 52205                | 312             | 226      | 228      | 235      | 239      | 181      | 183      | 192      | 194      | 245      | 247      | 145      | 153      |
| Touriga-Nacional N       | 52206                | 313             | 226      | 236      | 235      | 235      | 181      | 189      | 188      | 194      | 245      | 245      | 145      | 153      |
| Trajadura B              | 52710                | 314             | 226      | 236      | 235      | 247      | 181      | 185      | 186      | 186      | 247      | 247      | 145      | 153      |
| Transancora N            | 41206                | 315             | 226      | 232      | 235      | 259      | 189      | 189      | 188      | 196      | 245      | 251      | 137      | 159      |
| Trigueira Rs             | 50909                | 316             | 238      | 240      | 235      | 253      | 181      | 189      | 188      | 188      | 245      | 247      | 147      | 153      |
| Trincadeira N            | 53006                | 317             | 234      | 238      | 235      | 245      | 181      | 185      | 188      | 204      | 247      | 251      | 135      | 153      |
| Trincadeira-Branca B     | 51012                | 318             | 234      | 238      | 235      | 235      | 175      | 181      | 188      | 188      | 247      | 247      | 145      | 147      |
| Trincadeira-das-Pratas B | 52216                | 319             | 238      | 240      | 235      | 253      | 189      | 194      | 188      | 188      | 251      | 257      | 143      | 145      |
| Triunfo N                | 41509                | 320             | 236      | 238      | 239      | 243      | 181      | 181      | 188      | 192      | 247      | 255      | 147      | 151      |
| Uva-Cão B                | 51415                | 321             | 222      | 232      | 235      | 235      | 181      | 189      | 188      | 196      | 247      | 251      | 135      | 153      |
| Uva-Cavaco B             | 51211                | 322             | 234      | 238      | 235      | 235      | 181      | 191      | 186      | 188      | 247      | 251      | 139      | 153      |
| Valbom N                 | 53206                | 324             | 236      | 238      | 235      | 253      | 181      | 181      | 188      | 188      | 243      | 247      | 147      | 147      |
| Valdosa N                | 51608                | 325             | 232      | 234      | 235      | 249      | 181      | 181      | 188      | 200      | 247      | 247      | 145      | 147      |
| Varejoa N                | 50808                | 328             | 222      | 226      | 235      | 243      | 181      | 181      | 186      | 196      | 247      | 247      | 135      | 153      |
| Vencedor B               | 52111                | 329             | 226      | 236      | 235      | 245      | 179      | 181      | 188      | 204      | 247      | 251      | 139      | 147      |
| Verdelho-Tinto N         | 51806                | 332             | 228      | 236      | 235      | 245      | 181      | 189      | 188      | 200      | 251      | 259      | 135      | 145      |
| Verdial-Tinto N          | 41208                | 334             | 226      | 228      | 235      | 235      | 179      | 183      | 188      | 188      | 247      | 251      | 145      | 147      |
| Vinhão N                 | 51902                | 335             | 222      | 226      | 235      | 259      | 189      | 189      | 188      | 196      | 245      | 251      | 135      | 137      |
| Viognier B               | 40807                | 336             | 226      | 232      | 235      | 245      | 185      | 191      | 188      | 200      | 251      | 251      | 135      | 141      |
| Viosinho B               | 52715                | 337             | 232      | 232      | 235      | 239      | 185      | 189      | 186      | 188      | 243      | 245      | 135      | 153      |
| Vital B                  | 52614                | 338             | 222      | 240      | 235      | 235      | 181      | 194      | 188      | 188      | 247      | 253      | 147      | 153      |
| Zinfandel N              | 41409                | 341             | 226      | 236      | 243      | 245      | 179      | 181      | 200      | 204      | 237      | 259      | 135      | 145      |

TABLE II

Genetic profiles, at 6 microsatellite loci, of 40 grapevine cultivars officially authorized for wine production in Portugal for which 17 synonymous were detected. The cultivars are referred by the name, the reference number at Coleção Ampelográfica Nacional and the Portaria number. Allele size are given in base pairs. B, N and Rs correspond to green yellow, blue black and rose colour of the berry, respectively. *Tamanho dos alelos para seis loci de microsatélites de 40 castas oficialmente autorizadas para a produção de vinho em Portugal e para as quais foram identificadas 17 sinónimas. As castas são referidas pelo nome oficial, referência na Coleção Ampelográfica Nacional e na Portaria nº 428/2000. B, N e Rs correspondem a castas brancas, tintas e rosadas respectivamente*

| Cultivar Name          | Collection Reference | Portaria Number | VVMD 5   |          | VVMD 7   |          | VVMD 27  |          | VrZAG 62 |          | VrZAG 79 |          | VVS 2    |          |
|------------------------|----------------------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                        |                      |                 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 |
| Alfrocheiro N          | 52003                | 4               | 226      | 238      | 249      | 253      | 179      | 189      | 188      | 200      | 251      | 251      | 145      | 153      |
| Tinta-Bastardinha N    | 51107                | 289             | 226      | 238      | 249      | 253      | 179      | 189      | 188      | 200      | 251      | 251      | 145      | 153      |
| Alvarelhão-Branco B    | 51118                | 13              | 226      | 232      | 235      | 259      | 179      | 189      | 188      | 194      | 251      | 251      | 135      | 153      |
| Branco-Gouvães B       | 41105                | 51              | 226      | 232      | 235      | 259      | 179      | 189      | 188      | 194      | 251      | 251      | 135      | 153      |
| Touriga-Branca B       | 51515                | 310             | 226      | 232      | 235      | 259      | 179      | 189      | 188      | 194      | 251      | 251      | 135      | 153      |
| Amaral N               | 52907                | 16              | 222      | 232      | 235      | 259      | 189      | 189      | 188      | 196      | 245      | 251      | 145      | 159      |
| Melhorio N             | 41205                | 188             | 222      | 232      | 235      | 259      | 189      | 189      | 188      | 196      | 245      | 251      | 145      | 159      |
| Barreto N              | 41302                | 34              | 228      | 238      | 239      | 239      | 183      | 189      | 188      | 192      | 251      | 257      | 147      | 159      |
| Bragão N               | 41307                | 47              | 228      | 238      | 239      | 239      | 183      | 189      | 188      | 192      | 251      | 257      | 147      | 159      |
| Bastardo-Tinto N       | 51108                | 38              | 222      | 238      | 235      | 245      | 175      | 181      | 188      | 204      | 247      | 247      | 139      | 153      |
| Tinta-Lisboa N         | 51407                | 295             | 222      | 238      | 235      | 245      | 175      | 181      | 188      | 204      | 247      | 247      | 139      | 153      |
| Carrega-Tinto N        | 51603                | 72              | 234      | 238      | 235      | 249      | 179      | 194      | 188      | 200      | 251      | 257      | 145      | 153      |
| Grossa N               | 52906                | 152             | 234      | 238      | 235      | 249      | 179      | 194      | 188      | 200      | 251      | 257      | 145      | 153      |
| Cinsaut N              | 53805                | 92              | 226      | 226      | 243      | 247      | 179      | 181      | 188      | 204      | 255      | 259      | 127      | 133      |
| São-Saul N             | 51502                | 266             | 226      | 226      | 243      | 247      | 179      | 181      | 188      | 204      | 255      | 259      | 127      | 133      |
| Dona-Branca B          | 51717                | 109             | 236      | 240      | 235      | 235      | 179      | 185      | 186      | 186      | 251      | 251      | 145      | 159      |
| Folha-de-Figueira B    | 51514                | 130             | 236      | 240      | 235      | 235      | 179      | 185      | 186      | 186      | 251      | 251      | 145      | 159      |
| Farinheira B           | 41304                | 123             | 226      | 232      | 235      | 253      | 181      | 189      | 188      | 194      | 247      | 251      | 135      | 145      |
| Malvasia-Parda B       | 50913                | 177             | 226      | 232      | 235      | 253      | 181      | 189      | 188      | 194      | 247      | 251      | 135      | 145      |
| Gigante B              | 40504                | 138             | 234      | 240      | 235      | 245      | 181      | 181      | 196      | 204      | 237      | 243      | 135      | 145      |
| Valente B              | 40502                | 326             | 234      | 240      | 235      | 245      | 181      | 181      | 196      | 204      | 237      | 243      | 135      | 145      |
| Marufo N               | 52002                | 187             | 228      | 232      | 235      | 239      | 183      | 194      | 188      | 192      | 247      | 257      | 145      | 147      |
| Mourisco-Roxo Rs       | 52001                | 208             | 228      | 232      | 235      | 239      | 183      | 194      | 188      | 192      | 247      | 257      | 145      | 147      |
| Molar N                | 52703                | 192             | 226      | 238      | 235      | 253      | 181      | 189      | 188      | 194      | 245      | 261      | 135      | 153      |
| Rabo-de-Ovelha-Tinto N | 51703                | 246             | 226      | 238      | 235      | 253      | 181      | 189      | 188      | 194      | 245      | 261      | 135      | 153      |
| Ramisco-Tinto N        | 51503                | 248             | 226      | 238      | 235      | 253      | 181      | 189      | 188      | 194      | 245      | 261      | 135      | 153      |
| Saborinho N            | 51711                | 260             | 226      | 238      | 235      | 253      | 181      | 189      | 188      | 194      | 245      | 261      | 135      | 153      |
| Tinta-Negra N          | 51202                | 299             | 226      | 238      | 235      | 253      | 181      | 189      | 188      | 194      | 245      | 261      | 135      | 153      |
| Tinta-Porto-Santo N    | 41701                | 303             | 226      | 238      | 235      | 253      | 181      | 189      | 188      | 194      | 245      | 261      | 135      | 153      |
| Molinha B              | 51911                | 193             | 226      | 236      | 235      | 239      | 179      | 181      | 188      | 194      | 247      | 251      | 147      | 153      |
| Tamarez B              | 51910                | 279             | 226      | 236      | 235      | 239      | 179      | 181      | 188      | 194      | 247      | 251      | 147      | 153      |
| Pau-Ferro N            | 52103                | 217             | 222      | 238      | 235      | 235      | 179      | 189      | 186      | 188      | 251      | 261      | 135      | 135      |
| Tinta-Caiada N         | 51905                | 290             | 222      | 238      | 235      | 235      | 179      | 189      | 186      | 188      | 251      | 261      | 135      | 135      |
| Tinta-Lameira N        | 50704                | 294             | 222      | 238      | 235      | 235      | 179      | 189      | 186      | 188      | 251      | 261      | 135      | 135      |
| Jampal B               | 52515                | 155             | 226      | 236      | 239      | 253      | 181      | 189      | 188      | 188      | 247      | 251      | 139      | 145      |
| Pinheira-Branca B      | 50714                | 228             | 226      | 236      | 239      | 253      | 181      | 189      | 188      | 188      | 247      | 251      | 139      | 145      |
| Budelho B              | 40707                | 56              | 232      | 232      | 235      | 253      | 179      | 189      | 186      | 194      | 245      | 251      | 135      | 153      |
| Samarrinho B           | 51516                | 262             | 232      | 232      | 235      | 253      | 179      | 189      | 186      | 194      | 245      | 251      | 135      | 153      |
| Sabro B                | 51213                | 261             | 222      | 234      | 235      | 245      | 181      | 181      | 186      | 204      | 247      | 247      | 141      | 153      |
| Síria B                | 51914                | 275             | 222      | 234      | 235      | 245      | 181      | 181      | 186      | 204      | 247      | 247      | 139      | 153      |

TABLE III

Genetic profiles, at 6 microsatellite loci, of 29 grapevine cultivars officially authorized for wine production in Portugal of which 11 have identical SSR profiles but different berry colour. The cultivars are referred by the name, the reference number at Coleção Ampelográfica Nacional and the Portaria number. Allele size are given in base pairs. B, N and Rs correspond to green yellow, blue black and rose colour of the berry, respectively

*Tamanho dos alelos para seis loci de microssatélites de 29 castas oficialmente autorizadas para a produção de vinho em Portugal. Nestas castas há 11 que embora tendo o mesmo perfil de SSR têm mutações na cor do bago. As castas são referidas pelo nome oficial, referência na Coleção Ampelográfica Nacional e na Portaria nº 428/2000. B, N e Rs correspondem a castas brancas, tintas e rosadas respectivamente*

| Cultivar Name            | Collection Number | Portaria Number | VVMD 5   |          | VVMD 7   |          | VVMD 27  |          | VrZAG 62 |          | VrZAG 79 |          | VVS 2    |          |
|--------------------------|-------------------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                          |                   |                 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 | allele 1 | allele 2 |
| Bastardo N               | 52803             | 35              | 238      | 238      | 235      | 253      | 175      | 189      | 188      | 188      | 245      | 247      | 145      | 153      |
| Graciosa N               | 50304             | 147             | 238      | 238      | 235      | 253      | 175      | 189      | 188      | 188      | 245      | 247      | 145      | 153      |
| Bastardo-Roxo Rs         | 41708             | 37              | 238      | 238      | 235      | 253      | 175      | 189      | 188      | 188      | 245      | 247      | 145      | 153      |
| Carão-de-Moça B          | 51612             | 67              | 232      | 240      | 239      | 243      | 185      | 189      | 194      | 204      | 245      | 251      | 135      | 153      |
| Folgasão B               | 52709             | 128             | 232      | 240      | 239      | 243      | 185      | 189      | 194      | 204      | 245      | 251      | 135      | 153      |
| Folgasão-Roxo Rs         | 52708             | 129             | 232      | 240      | 239      | 243      | 185      | 189      | 194      | 204      | 245      | 251      | 135      | 153      |
| Fernão-Pires B           | 52810             | 125             | 226      | 240      | 235      | 235      | 183      | 194      | 188      | 194      | 247      | 247      | 147      | 153      |
| Fernão-Pires-Rosado Rs   | 52815             | 126             | 226      | 240      | 235      | 235      | 183      | 194      | 188      | 194      | 247      | 247      | 147      | 153      |
| Godelho B                | 41101             | 139             | 226      | 238      | 235      | 239      | 185      | 189      | 186      | 188      | 251      | 251      | 153      | 159      |
| Gouveio B                | 52112             | 142             | 226      | 238      | 235      | 239      | 185      | 189      | 186      | 188      | 251      | 251      | 153      | 159      |
| Gouveio-Roxo Rs          | 41706             | 146             | 226      | 238      | 235      | 239      | 185      | 189      | 186      | 188      | 251      | 251      | 153      | 159      |
| Malvasia-Fina B          | 52512             | 175             | 226      | 240      | 235      | 253      | 179      | 194      | 188      | 188      | 247      | 251      | 145      | 147      |
| Malvasia-Fina-Roxa Rs    | 52612             | 176             | 226      | 240      | 235      | 253      | 179      | 194      | 188      | 188      | 247      | 251      | 145      | 147      |
| Malvasia-Cândida B       | 50911             | 173             | 226      | 226      | 239      | 245      | 179      | 183      | 188      | 202      | 243      | 247      | 145      | 147      |
| Malvasia-Cândida-Roxa Rs | 50810             | 174             | 226      | 226      | 239      | 245      | 179      | 183      | 188      | 202      | 243      | 247      | 145      | 147      |
| Mário-Feld N             | 41606             | 185             | 228      | 238      | 235      | 239      | 185      | 189      | 188      | 194      | 239      | 245      | 139      | 153      |
| Pinot-Blanc B            | 51713             | 230             | 228      | 238      | 235      | 239      | 185      | 189      | 188      | 194      | 239      | 245      | 139      | 153      |
| Pinot-Gris Rs            | 53708             | 231             | 228      | 238      | 235      | 239      | 185      | 189      | 188      | 194      | 239      | 245      | 139      | 153      |
| Pinot-Noir N             | 53706             | 232             | 228      | 238      | 235      | 239      | 185      | 189      | 188      | 194      | 239      | 245      | 139      | 153      |
| Chasselas B              | 53609             | 85              | 228      | 236      | 235      | 243      | 185      | 189      | 194      | 204      | 251      | 259      | 135      | 145      |
| Chasselas-Roxo Rs        | 53607             | 86              | 228      | 236      | 235      | 243      | 185      | 189      | 194      | 204      | 251      | 259      | 135      | 145      |
| Chasselas-Salsa B        | 40608             | 88              | 228      | 236      | 235      | 243      | 185      | 189      | 194      | 204      | 251      | 259      | 135      | 145      |
| Uva-Salsa B              | 50311             | 323             | 228      | 236      | 235      | 243      | 185      | 189      | 194      | 204      | 251      | 259      | 135      | 145      |
| Moscatel-Galego-Branco B | 52915             | 199             | 228      | 236      | 229      | 245      | 179      | 194      | 186      | 196      | 251      | 255      | 135      | 135      |
| Moscatel-Galego-Roxo Rs  | 54005             | 200             | 228      | 236      | 229      | 245      | 179      | 194      | 186      | 196      | 251      | 255      | 135      | 135      |
| Verdelho B               | 50317             | 330             | 222      | 232      | 235      | 253      | 181      | 189      | 194      | 196      | 247      | 251      | 135      | 153      |
| Verdelho-Roxo Rs         | 51513             | 331             | 222      | 232      | 235      | 253      | 181      | 189      | 194      | 196      | 247      | 251      | 135      | 153      |
| Malvasia-Preta N         | 53205             | 178             | 226      | 236      | 245      | 249      | 181      | 189      | 200      | 204      | 247      | 251      | 139      | 153      |
| Pinheira-Roxa Rs         | 41703             | 229             | 226      | 236      | 245      | 249      | 181      | 189      | 200      | 204      | 247      | 251      | 139      | 153      |

countries, for example Alicante-Branco, Aragonez, Moscatel-Galego-Branco, Moscatel-Graúdo, Tália and Tinta-Miúda; 4) a group including 37 varieties that have recently been introduced (mainly from France and Germany) in the national viticulture, as for example, Cabernet-Franc, Sauvignon, Syrah and Riesling.

## CONCLUSIONS

The preservation of grapevine genetic resources is of prime importance. However, the management of a grapevine germplasm collection is expensive, requiring considerable land area. So, it is important to eliminate repetitions and misclassifications.

The microsatellite analysis was very useful in the identification and discrimination of all the studied cultivars. Investigation of putatively synonymous cultivars has resulted in the confirmation of 17 synonymous. We consider that this work contributed to improve the management of the Grapevine Portuguese Collection. In addition, this set of microsatellite loci will allow for comparisons with genotypes from

any international collection.

Furthermore, the present study will give a good technical support for the update of the list of the cultivars officially authorized for wine production in Portugal (Portaria nº 428/2000, Diário da República nº 163, 17th July 2000), and will also be a support for the trade control of plant material.

The SSR database will be available at the web page of Instituto Nacional de Recursos Biológicos ([www.inrb.pt](http://www.inrb.pt)). This database will be regularly updated, what means that new information will be uploaded when necessary.

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