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Genetic Characterization of Grapevine Varieties from Emilia-Romagna (northern Italy) discloses unexplored genetic resources

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Short version of title: Characterization of Grapes from Emilia-Romagna

Abstract

A set of 178 grape accessions collected in Emilia Romagna, from widely cultivated to nearly extinct and thus maintained in *ex-situ* regional repositories, were analyzed at ten microsatellite (SSR) markers with the aim of their correct identification. Ampelographic and local historical information were also gathered. Varietal identity was established through the comparison with reference SSR profiles often supported by vine morphology. The work demonstrated the presence in the region, under local (often confusing) names, of varieties in common with other regions/countries, but also identified a large amount of local, unique genotypes highly worthy of being preserved. Forty-nine percent of the investigated varieties corresponded to cultivars included in the Italian National Catalogue of Grape Varieties or were of likely foreign origin, while 62 out of the 122 unique genotypes are not reported or described in the literature, unless mentioned in historical documents. Yet they likely belong to local germplasm, possibly native to the area. Some of these neglected grapes, like Pellegrina, Biondello and

Rossiola, are prospective candidates for market exploitation of varietal wines. The approach applied, based on varietal identification by markers supported by ampelography and historical evidence, represents one of the key steps in local cultivated grapevine studies and development.

Key words: *Vitis vinifera*, DNA, microsatellite, genetic diversity, genetic resources, germplasm analysis.

Introduction

Italy is one of the top wine producers in the world (49.2 x 10^6 hL of wine produced on average in the three years 2015-2017) with 652,000 ha of area under vines and € 5.98 × 10^8 of wine export values according to the Ismeamercati website (www.ismeamercati.it). Emilia-Romagna is a traditional wine grape growing region located in northern Italy (Fig. 1) and characterized by great soil diversity and climatic variability due to its geographical position between the Po river in the north, the Apennine mountains in the south and Adriatic Sea in the east. Viticulture in the area dates back to Roman times as reported by Columella (Calzecchi Onesti 1977) if not before, so there is a long wine-making tradition. Emilia-Romagna is today the third largest wine-producing region in Italy (ISTAT 2018, www.istat.it/it/agricoltura), being suitable for the growth of 99 currently authorized wine-grape cultivars. Numerous minor varieties moderately cultivated, neglected or nearly extinct are also present in the region as residues of the long grape growing tradition. This source of genetic diversity has been collected thanks to regional funding, which has allowed the *ex-situ* conservation of many of these accessions, preventing them from disappearing. In addition, several varieties have been maintained on farms by generations of families.

It is widely recognized that local grape diversity is a valuable resource to be protected and maintained both for breeding programs and for marketing of original wines related to unique *terroirs*, bringing local economic benefit (see WineMosaic project: http://www.winemosaic.org/en/; Maul et al. 2018).

Moreover, in the current climate warming context the promotion of local grapevines naturally adapted and resilient to environmental constraints may further improve the recovery, evaluation and use of varietal diversity (Gisbert et al. 2018).

One of the first steps towards grape variety study and use lies in the correct identification of the recovered accessions, a difficult task due to the vast number of synonyms, homonyms and mistaken names involving both local and important grape varieties spread across Italy and Europe.

Grape morphological descriptions, usually applied to the characterization of species and varieties of the *Vitis* genus, have been associated to Simple Sequence Repeats (SSR) markers since the 1990s, when they were applied to varietal fingerprint (Thomas et al. 1993), becoming increasingly widely used for vine identification. Nine SSR were selected (This et al. 2004, Maul et al. 2012) and recommended that they be shared and used by the scientific community to allow the comparison of published variety profiles within molecular databases or publications focused on local germplasm from various areas (to name a few examples, Sefc et al. 2009; Ghaffari et al. 2013, Žulj Mihaljević et al. 2013, Schneider et al. 2014). All this information is merged in the periodically updated and highly useful International Vitis Database (VIVC) (Maul and Töpfer 2015).

This study aims at the first comprehensive molecular characterization of Emilia-Romagna grapevine diversity, providing the SSR profiles of 178 accessions and their correct identification via comparison with reference genotypes. This allowed to demonstrate the presence of unique, never reported genotypes, as well as the introduction of materials from abroad, currently cultivated in the region under different names. Historical and ampelographic clues help to establish a clear, unambiguous classification when local names, synonyms, homonyms or mistaken designations occur. We also briefly speculate on the potential opportunity for commercial exploitation of some rarer local varieties.

Material and methods

The genetic profiles of 178 accessions (Table 1) rescued in Emilia-Romagna and known as local traditional varieties were examined. The accessions were retrieved from five grapevine collections recognized by Emilia-Romagna Regional Administration (Det. n. 8396, 21/06/2012): Astra Innovazione e Sviluppo (Tebano di Faenza, RA), Mossi Aziende Agricole Vitivinicole (Ziano Piacentino, PC), A.U.B. Azienda Agraria Alma Mater Studiorum - Università di Bologna (Bologna), Istituto d'Istruzione Superiore "A. Zanelli" and Azienda Agricola Bargello di Rinaldi Aldo (Reggio Emilia) that were formed in the last years during ampelographic scouting.

DNA was extracted from young leaves sampled in the field and then lyophilized, following the procedure described by Mercado et al. 1999. Samples were genotyped using a set of 10 nuclear SSR loci, nine of them developed as common markers for international use (Maul et al. 2012). The 10 markers were VvS2, VvMD5, VvMD7, VvMD25, VvMD27, VvMD28, VvMD32, VrZAG62, VrZAG79 and VvMD6 (for detailed information on markers see www.eu-vitis.de/index.php and www.vitisdb.it/descriptors/microsatellites). PCR products were then analyzed on an ABI 3730 DNA Analyzer (Applied Biosystems, Foster City, CA, USA). Data were processed using Peak Scanner Software (ver. 1.0; Applied Biosystems), and alleles were defined by their size in base pairs, by comparison with the standard size (GeneScan™ 500 LIZ™ dye Size Standard, Applied Biosystems).

To evaluate the markers used, the following statistical parameters were calculated for every locus on genotypes with unique profiles using CERVUS (ver. 3.0.7; Field Genetics Ltd; www.fieldgenetics.com): numbers of alleles, observed (Hearne et al. 1992) and expected heterozygosity (Nei 1987), estimated frequency of null alleles (Pemberton et al. 1995), polymorphic information content (PIC) and probability of identity (PI) for overall loci. The PIC of each marker was calculated from allele frequency in the population and provides a measure of informativeness based on expected heterozygosity (Hearne et al. 1992). The PI is the probability that two individuals drawn at random from a population will have the same genotype at multiple loci (Waits et al. 2001).

For varietal identification, the obtained SSR profiles were compared with an internal nSSR database (CNR – IPSP that includes more than 900 unique grapevine genotypes, unpublished), as well as other national and international on-line sources: the Italian *Vitis* Database (IVD, www.vitisdb.it), the European *Vitis* Database (EVD, www.eu-vitis.de), the National Clonal Germplasm Repository (NCGR–Davis, www.ars.usda.gov/Main/docs.htm? docid=13743), Pl@nt Grape (from France, plantgrape.plantnet-project.org), the Swiss Vitis Microsatellite Database (SVMD, http://www1.unine.ch/svmd/) and the *Vitis* International Variety Catalogue (VIVC, http://www.vivc.de/). Grapevine nSSR published genotypes from other literature sources were also included. Before comparison, the allele size of each marker in our dataset was adjusted to that of each source through common genotypes, usually international varieties used as standards. Because of possible

genotyping errors, a maximum threshold of two discrepancies on the total 20 alleles was accepted (two in the case of 9 common markers, and one when there were 6 common nSSR loci), providing also the good matching with vine morphological profile (through photos or notations) when available (see below).

When not yet included in the Regional Inventory of genetic resources for food and agriculture (available on line at: https://agricoltura.regione.emilia-romagna.it/agriturismo-agricultura/temi/agrobiodiversita/schede-specie-vegetali/vite), the morphological profiles of the investigated grapevines were detected (including photos) following the list of primary descriptors in the European *Vitis* Database (http://www.eu-vitis.de/docs/descriptors/mcpd/Descriptors_EUVitisDB_11Jan12.pdf), or the OIV Priority descriptor list (http://www.oiv.int/en/technical-standards-and-documents/description-of-grape-varieties/oiv-descriptor-list-for-grape-varieties-and-vitis-species-2nd-edition). Plant morphological features corroborated the varietal identity suggested by DNA profiling. They also played a key role in understanding historical documents.

Results

The SSR analyses performed on the 178 grapevine accessions (Table 1) revealed the presence of 122 unique genotypes (Supplemental Table 1), so that internal synonyms (i.e. synonyms within the analyzed dataset) accounted for 30% of the total.

Statistics on these unique profiles indicated 105 total alleles, ranging from 7 (VVMD6) to 14 (VVMD32), with an average of 10.5 alleles per locus (Supplemental Table 2). The expected heterozygosity varied between 69.1% and 85.2%, while observed heterozygosity was between 74.6% and 90.2%, with averages of 81% and 80% respectively. The probability of null alleles was very close to 0, mean polymorphic information content was 0.77 and the total combined non-exclusion probability of identity was 1.133×10^{-12}. Therefore, exactly matching accessions were considered mutants or synonyms, in turn identified by vine morphology observations.

Comparison of the 122 unique molecular profiles with the molecular data in the national and international databases and/or in the literature gave rise to the detection of several external synonymies, leading to the true varietal identity being established for many accessions. Table 2 reports the 52 accessions identified with cultivars registered in the Italian Grape Variety Catalogue (Table 2A), mostly corresponding to varieties

authorized to be grown in Emilia-Romagna (36 profiles), while 8 matched non-Italian cultivars (Table 2B). The remaining 62 genotypes were thus ascribed to local, not officially registered grapes. These profiles were therefore compared with molecular data in the literature examining local, neglected varieties of the area. A genetic correspondence was found for 20 out of the 62 (Table 3A), while 42 profiles were accessions never reported in previous studies (Table 3B), so were unique genetic material. Most of this local germplasm is grown locally, but often highly threatened.

Discussion

Although the proportion of internal synonyms was moderate, accounting for 30% of the nearly 200 investigated accessions, the amount of presumed novel, original material was greatly reduced by the recognition of many accessions as cultivars already reported/described, or even included in the national Catalogue. The screening of the collected materials by DNA profiling, thanks to available true to type references, is therefore a key step in local grapevine germplasm studies. It is thus essential to perform reliable genotyping. In this work, the nSSR profile matching with references was mostly 100%. The comparison of photos or notations on the major plant organs (leaves and bunches) of both questionable accession and reference, usefully supports genetics.

Homonym varieties

The accession Cor d'usel, identified as Grechetto gentile B. (a variety also known in other Italian regions as Grechetto di Todi), resulted spread under the synonyms of Pignolo, Pignoletto or Ribolla in as many as nine areas of eastern Romagna, from Bologna to Forlì, Ravenna and Rimini (Table 2A and Table 1). Since the 1960s this grape has been widely planted on the Bologna hills as Pignoletto, but the denomination Rebola/Ribolla was documented in the region from the 14th century by the statute of Savignano (Delucca and Carli 1994**)**. In our dataset, however, the name Ribolla is in common with two other distinct accessions, Ribolla R17 and Ribolla R24 (Table 3B), matching neither Grechetto gentile B. nor Ribolla gialla B. included in the Italian Grape Variety Catalogue. In addition, Rebula stara (old Rebula) from the Balkans was identified according to VIVC as Heunisch Weiss (alias Gouais blanc), thereby adding another homonym to the group. Many distinct varieties

named Rebola/Ribolla attest to the great appeal that the homonym wine had in the past in north-eastern Italy as well as in the nearby Balkan regions. Moreover, they suggest prudence in the interpretation of historical reports of grapes as homonyms, due to the uncertain attribution of the true varietal identity. The same is true for the homonyms Malvasia and Lambrusco.

The three accessions sharing the name Lambrusco (Table 2A and Table 3B), showed different molecular profiles. Lambrusco di Fiorano (Table 2A) was registered in the Italian Catalogue in 2016 as Lambrusco del Pellegrino N.; Lambrusco picol ross (Table 2A) and Lambrusco di Corbelli (Table 3A) did not match any of the twelve different cultivars sharing the name Lambrusco in the Catalogue. The former, a traditional grapevine from Reggio Emilia province, was confirmed as being a synonym of Terrano N. (Meglioraldi et al. 2013), locally named Cagnina, while Lambrusco di Corbelli was likely a unique, unreported genotype. Instead, two other accessions included in our study, Gialmona and Scorzamara recovered in Reggio Emilia province (where Lambruscos are widely cultivated) were identified as the very common Lambrusco Marani N. and Lambrusco Grasparossa N. respectively (Table 2A). The names Gialmona and Scorzamara were likely mistaken, as according to historical reports they should refer to different varieties.

Varieties imported or present elsewhere

Many investigated accessions corresponded to cultivars typical of regions bordering Emilia-Romagna, like Tuscany (Vernaccia di San Gimignano B., Bonamico N., Ciliegiolo N.), Lombardy (Schiava N., Mornasca N.), Veneto (Moscato giallo B., Marzemina bianca B., Verdicchio bianco B. known as Trebbiano di Soave B., Verduzzo trevigiano B.) and Marche (Verdicchio bianco B., Mostosa B.). Their presence in Emilia-Romagna could derive from a former introduction or a wider spread in the past. They are currently known in the region under local names or misnomers, so their true identity is of interest to local growers and the wine industry.

Foreign grapes too, casually introduced sometimes from distant areas, were discovered under local and often confusing or incorrect names. Two Colorino accessions (Colorino meaning “deeply colored grapes”), Colorino (Ricci) and Colorino (Siba Ladino) both flesh-colored, were found to correspond to the interspecific hybrid

Seibel 1077 and to a grape grown in Piedmont under the name of Teinturier ad acino rotondo respectively (Table 2B and Table 3A).

We also found grapes in common with the varietal assortment of other neighboring countries. Rossa di Monte Castello corresponds to Glacière once cultivated in Provence, while Stciucaera bianca is the synonym of Blanc des Hombes, a little-known variety mentioned in Switzerland (Table 2B). These findings confirm a flow of varieties across the Alps, probably occurring on several occasions in the past. A truly imported cultivar is Jacquez (a *Vitis aestivalis* hybrid originating in the USA), that spread from France to Italy in 19th century and is grown in Emilia Romagna as Fogarina or Nibiol, both obviously incorrect names. Furthermore, genotypes from North Africa (Sbebbi nero synonym of Bezoul El Khadem d'Algerie), Eastern Europe (Uva picciona, synonym of Coarna alba from Moldova) and Southern Europe (Uva di S. Andrea alias Palomino fino from Spain, and Malvasia di Rimini identical to Thrapsathiri from Greece) attest to the wide circulation of materials in the Mediterranean basin during former times.

As to the last example, Thrapsathiri alias Malvasia di Rimini, one of the seven homonym Malvasia included in this work (Table 1), this is probably the most northern accession of this cultivar, typical of the Aegean islands and currently part of the Malvasia wine blend from Crete. Yet the question remains whether this variety was spread across the Adriatic Sea by none other than the ancient Greeks, as previously reported for Malvasia delle Lipari (Crespan et al. 2006), or was a more recent arrival. Regarding this, it is worth mentioning that the promontory of Focara located at the Romagna border was often visited in ancient times by Greek merchants going to the renowned emporium of Spina (Braccesi 1969).

Regional varieties not listed in the National Catalogue

Sixty-two accessions analyzed in this study corresponded to varieties typical of Emilia Romagna. As already mentioned, many local synonyms were found within this regional germplasm, indicating a rather intense cultivation of local varieties in the past, and their spread under different names (Table 3).

Besides the internal synonyms, 20 out of the 62 regional varieties showed the same profile as cultivars already reported as typical of the region (Table 3A). As many as 42 were genotypes not matching with any reference,

nor previously described (Table 3B). Most of them are threatened with extinction. Their conservation in regional repositories is thus highly recommended.

Among these lesser known local varieties (Table 3B), some show merit for potential exploitation. Pellegrina, for example, was wrongly reported as a synonym of Spergola and Sauvignon blanc (Cosmo and Polsinelli, 1961). Our findings clearly showed the two genotypes called Pellegrina, although distinct from one another, do not correspond to either Spergola or to Sauvignon blanc. Pellegrina (Bonfatti), currently grown in a small area although not officially authorized, is ideal for producing sparkling wines thanks to its high acidity (Fontana et al. 2014).

Biondello is another local variety not listed in the Catalogue that preliminary tests show has remarkable agronomic traits (good vigor and yield, high basal bud fertility, low sensitivity to downy and powdery mildew) and juice quality (appropriate sugar content, high acidic levels), making it suitable to produce sparkling wines even in warm climate conditions.

The red berry Rossiola, also known as Uva rosa or Uva tosca, was shown to be a different genotype from the two almost homonym white varieties Rossola (Tebano) and Rossola di Bertinoro, thus excluding a possible common origin by mutation (Table 3B). The red Rossiola, recovered in an old vineyard on the sandy coastal area of Ferrara province and in the past confused with the better known cv Fortana N. (Casazza, 1845), maintains a good level of acidity in the grapes even if grown in one of the hottest areas of Emilia-Romagna. It gives fine varietal rosé wines of distinctive aroma, or could go into the blend of typical wines from coastal sandy soils.

The last three mentioned cultivars deserve to be considered for their addition in the Catalogue, and admitted to cultivation according to the European rules.

Correct accession naming

Forty-nine percent of the accessions investigated proved identical to grape varieties included in the National Catalogue or were of foreign origin, therefore already known and described. As the study was addressed to local, often neglected or threatened resources, identification with known varieties (though of minor importance) was highly relevant either for conservation policy or commercial exploitation. Indeed, the study revealed that major

Italian cultivars such as Trebbiano toscano (alias Ugni blanc), Vernaccia di San Gimignano, Ciliegiolo and others, are grown in the region under local names like Albanella, Bianchino, Santa Maria nera, etc., therefore should not be considered endangered resources, but rather a source of intra-varietal diversity.

Looking at the accession denominations, it is worth underlining that 22% were correctly named (true names), 55% were synonyms, either local (used by farmers – 27%) or historical (i.e. reported in historical documents – 28%), while wrong designations (mistaken names because referring to different already-described and known cultivars) accounted for as much as 23% of the identified accessions (Table 2).

Examples of historical synonyms were Barbesino and Spergola B. (Filippetti et al. 2001), Cor d'Usel and Grechetto gentile B. (Silvestroni et al. 1985), Uva d'oro and Fortana N. (Rossi 2017), while Negretta, Bianca toscana and Lambrusco picol ross were local synonyms of Negretto N., Malvasia di Candia aromatica B. and Terrano N. respectively (Table 2A).

To distinguish variety homonyms is another key point of identification. The names of the five accessions Albana del paniere, Albana nera (Montanari), Albana nera (Monte Trebbio), Albana nera (Tebano) and Albana rossa (Table 1) refer to white Albana B., one of the most traditional grapes in Romagna used for Albana appellation wines. Thus, although sharing large-sized and long clusters with Albana B., none of these accessions matched with Albana B.: two were misnomers (Table 2A) and three were actually unknown (Table 3B). Similarly, Malvasia di Rimini, Malvasia profumata di Parma 1, Moscatellone nero, Moscato nero, Moscatello nero and Moscatone (Table 1) mostly sharing an aromatic profile similar to Malvasias and Moscatos, were erroneously assimilated to these cultivars, while instead all were misnomers or local synonyms of known flavored grapes, like Aleatico N. and Moscato giallo B. (Table 2A and 2B). Thus, following the process of varietal identification, understanding if an accession name is an acceptable local synonym or a mistaken, ambiguous or confusing denomination, is crucial for the further use and exploitation of that resource.

Conclusions

The study presents the results of varietal identification of a large set of minors, neglected and threatened grapevine accessions collected in Emilia-Romagna during 20 years of germplasm recovery and gathering

projects, which also led to the constitution of the grapevine collections. The work was based on DNA profiling supported by vine morphology observations and historical research. Out of the total 178 investigated accessions 122 unique genotypes were found, 62 of which corresponded to little known grapes, never described, and possibly native to Emilia-Romagna. These resources should be considered unique, therefore highly worthy of preservation. Their management as original genetic resources should be improved, increasing the number of maintained vine for each genotype or establishing duplicates in different places to avoid the threat of extinction. Some of them with peculiar traits deserve future evaluations aimed at commercial exploitation of varietal wines, also due to their resilience to the ongoing climate change conditions. Moreover, since SSR data of local and unique genotypes have been carefully checked, their profiles will soon be included in National and International databases, thus available to the scientific community.

The approach followed in this work allows the varietal diversity to be estimated correctly, unraveling erroneous denominations (often handed down from the past), and revealing the presence of genotypes that, despite belonging to already known cultivars, could be an important genetic resource in terms of intra-varietal variability, being cultivated and well-adapted to Emilia-Romagna climatic and environmental conditions. Varietal identification and correct naming indeed represent one of the key steps in local cultivated grapevine germplasm investigations, safeguard and exploitation.

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Figure 1. Location of the Emilia-Romagna region in the Italian peninsula and its administrative division in 9 provinces.

360 Table 1. The 178 grape cultivars/accessions examined in this study: berry color, use, cultural area.

Sample code	Accession name[a]	Berry color[b]	Use[c]	Cultural Area (Province or Region)[d]
1	Albana del paniere	B	W	FC
2	Albana nera (Montanari)	N	W	RA
3	Albana nera (Monte Trebbio)	N	W	FC
4	Albana nera (Tebano)	N	W	RA
5	Albana rossa	N	W	RA
6	Albanella (Cadriano)	B	W	BO
7	Albanella (Tellarini)	B	W	RA
8	Albanina nera	N	W	RA
9	Aleatico (Tebano)	N	W	BO
10	Aleatico (Zauli)	N	W	RA
11	Aleatico di S. Valentino	N	W	RE
12	Angela	B	W	BO
13	Balsamina	N	W	RA
14	Balzamino	N	W	RA
15	Barbesino	B	W	PC
16	Basgana	N	T-W	FE
17	Basoleina	N	W	RE
18	Bermestone	N	T	FE
19	Bertinora	B	T-W	FC
20	Berzemino capolico	N	W	RE
21	Besgano bianco	B	T	PC
22	Besgano rosso	N	T	PC
23	Bianca toscana	B	W	FC
24	Bianchetta di Bacedasco	B	W	PC
25	Bianchetta di Diolo	B	W	PC
26	Bianchino	B	W	FC
27	Bianchino (Vignoli)	B	W	RA
28	Biondello	B	W	FC
29	Bottona	B	W	BO
30	Brumesta	N	T-W	FE
31	Bsolla	B	W	RA
32	Bucalò	B	W	PC
33	Burghisana	N	T	RA
34	Calora	B	W	PC
35	Canino	B	W	RN
36	Cargarello	B	W	RN
37	Cavazzina	N	W	RE
38	Caveccia	B	W	RA
39	Caveccia (Sant'Andrea)	B	W	RA
40	Cavecia (Bordone)	B	W	RA
41	Ciocca (Plessi)	B	W	MO
42	Ciocca (Tebano)	B	W	BO
43	Cioccherella	B	W	MO
44	Ciurlese	B	W	RN
45	Colombina	B	W	PC
46	Colorino (Ricci)	N	W	RN
47	Colorino (Siba Ladino)	N	W	FC
48	Cor d'Usel	B	W	RA
49	Cornacchia (Ercolani)	N	W	RA
50	Cornacchia (Tebano)	N	W	RA
51	Cornona	V	T	RE
52	Covra	N	W	RE
53	Covretto	N	W	RE
54	Crova	N	W	PC
55	Crovarina	N	W	PC
56	Dorata di Fontevivo	B	T-W	PR
57	Duraguzza	N	W	PC

58	Durella	B	W	RE
59	Famoso (Bragagni)	B	W	RA
60	Famoso (Conventino)	B	W	Marche region
61	Festasio	N	W	MO
62	Fogarina (Tebano)	N	W	RA
63	Fogarina di Gualtieri	N	W	RE
64	Fogliona	B	W-T	MO
65	Forcella (Bordone)	B	W	BO
66	Forcella (Tebano)	B	W	BO
67	Forcella (Tedeschini)	B	W	BO
68	Forcella (centenaria di Imola)	B	W	BO
69	Fortana CAB1	N	W	FE
70	Frattini	N	W	RA
71	Fruttano	N	W	PC
72	Gialmona	N	W	RE
73	Giottina	B	W	RE
74	Graplen	B	W	RA
75	Grattacoppa	N	W	RA
76	Gravarena	N	W	PC
77	Grillone	N	T	RA
78	Lambrusco di Corbelli	N	W	RE
79	Lambrusco di Fiorano	N	W	MO
80	Lambrusco picol ross	N	W	RE
81	Lanzesa	B	W-T	RA
82	Leck	B	W	PC
83	Liedga (centenaria "La Palazza")	B	T	FC
84	Lisora	B	W	PC
85	Madalona	N	W	RA
86	Maligia (Monari)	B	W	BO
87	Maligia (Tebano)	B	W	BO
88	Malvasia aromatica di Parma (Casalini)	B	W	PR
89	Malvasia bianca	B	W	RA
90	Malvasia bolognese	B	W	BO
91	Malvasia di Rimini	B	W	RN
92	Malvasia parmense	B	W	PR
93	Malvasia profumata di Parma 1	B	W	RE
94	Malvasia profumata di Parma 2	B	W	RE
95	Melara	B	W	PC
96	Molinelli	B	W	PC
97	Mollona	B	T	RE
98	Moscatello	B	W	FC
99	Moscatello nero	N	W	RA
100	Moscatellone nero	N	T	FC
101	Moscato nero	N	T	FC
102	Moscatone	B	W-T	RN
103	Mostarino	N	W	PC
104	Negretta 1	N	W	MO
105	Negretta 2	N	W	MO
106	Negrettino (Converselle)	N	W	FC
107	Negrettino (Sbarzalia)	N	W	RA
108	Negrettino (Torretta)	N	W	RA
109	Nero di Gonzaga	N	W	RA
110	Nibiol	N	W	RE
111	Paradisa	B	W	BO
112	Pargulona	N	T	FC
113	Pellegrina (Bonfatti)	B	W	MO
114	Pellegrina (Cadriano)	B	W	MO
115	Pignoletto (Rubini)	B	W	BO
116	Pignoletto (Tersi)	B	W	FC
117	Pignoletto (Zola)	B	W	BO

118	Pignolo	B	W	FC
119	Pignolo di Forlì	B	W	FC
120	Plissona	N	W	PC
121	Prunella	N	W	RA
122	Redga	B	W	RE
123	Ribolla 30	B	W	RN
124	Ribolla 31	B	W	RN
125	Ribolla R17	B	W	RN
126	Ribolla R23	B	W	RN
127	Ribolla R24	B	W	RN
128	Ribolla R3	B	W	RN
129	Rossa di Monte Castello	R	W-T	FC
130	Rossara	N	W	RE
131	Rossiola	R	W	FE
133	Rossola (Tebano)	B	W-T	FC
132	Rossola di Bertinoro	B	W-T	RA
134	Santa Maria	B	W	PC
135	Santa Maria nera	N	W	FC
136	Sauvignon rosso	N	W	RA
137	Sbebbi nero	N	T	FC
138	Scacco	B	W	FC
139	Scarsafoglia	B	W	RE
140	Sconosciuta di Castellarano	N	W	RE
141	Scorzamara (Neviani)	N	W	RE
142	Scorzamara (Rinaldi)	N	W	RE
143	Scorzamara val d'Enza	N	W	RE
144	Sgavetta	N	W	PC
145	Simonina (Cadriano)	N	W	MO
146	Simonina (Rinaldi)	N	W	RE
147	Spaltarina	N	W	RE
148	Squarciafoglia	B	W	MO
149	Stciucaera bianca	B	W	PC
150	Stciucaera rossa	B	W	PC
151	Termarina bianca	B	T-W	PR
152	Termarina rossa	N	T-W	PR
153	Tonda di S. Secondo	N	T-W	PR
154	Tosca	N	W	RE
155	Trasforini	B	W-T	FE
156	Trebbiano di Spagna	B	W	MO
157	Uva aceto	B	W	FE
158	Uva ciocca	B	W	MO
159	Uva d’oro 1	N	W	FE
160	Uva d’oro 2	N	W	MO
161	Uva d’oro raspo rosso	N	W	RA
162	Uva del prato	N	W	MO
163	Uva di S. Andrea	B	T-W	FC
164	Uva morta	G	W	RA
165	Uva nebbia	B	W	FC
166	Uva picciona	B	T	PR
167	Uva rosa	N	W	RA
168	Uva rosa (Agnoletti)	Rs	T	PR
169	Uva tosca (Tebano)	N	W	RE
170	Uva vacca	B	W	RN-FC
171	Varon	N	W	FE
172	Verdea	B	T-W	PC
173	Verdetto	B	W	RN
174	Verdicchio	B	W	MO
175	Vernaccia	B	W	FC
176	Vernaccina	B	W	RN
177	Verrucchiese	N	W	RN
178	Vite badia S. Andrea	N	W	FC

[a] Geographic or farmer's names are in brackets, useful to discriminate homonym accessions.
[b] According to OIV descriptor 225: B = white, R = red, Rs = rose, V = dark red-violet, G= Grey, N= blue-black.
[c] W, wine grape; T, table grape.
[d] Emilia-Romagna provinces: Bologna (BO), Ferrara (FE), Forlì-Cesena (FC), Modena (MO), Parma (PR), Piacenza (PC), Ravenna (RA), Rimini (RN), Reggio Emilia (RE).

Table 2. Matching genetic profiles within the sample set (internal synonyms) and/or with cultivars authorized to be grown in Italy listed in the Italian Grape Variety Catalogue (A) (followed by berry color B = white, N= blue-black) and with non-Italian cultivars (B).

A

Sample code	Accession names[a]	Internal synonyms[a]	Matching cultivars listed in the Italian Grape Variety Catalogue
2	Albana nera (Montanari) (mis)	Fruttano (syn), Uva d'oro 2 (syn), Uva d'oro raspo rosso (syn)	**Fortana N.***
3	Albana nera (Monte Trebbio) (mis)	Negretta 2 (loc syn), Negrettino (Torretta) (syn)	**Negretto N.***
6	Albanella (Cadriano) (mis)		**Trebbiano toscano B.***
7	Albanella (Tellarini) (syn)	Colombina (syn)	**Marzemina bianca B.**
9	Aleatico (Tebano) (true)	Aleatico (Zauli) (true), Moscatello nero (loc syn), Negrettino (Converselle) (mis), Vite badia S. Andrea (loc syn)	**Aleatico N.**
15	Barbesino (syn)		**Spergola B.***
23	Bianca toscana (loc syn)	Malvasia parmense (loc syn), Malvasia profumata di Parma 2 (loc syn)	**Malvasia di Candia aromatica B.***
26	Bianchino (mis)		**Vernaccia di S. Gimignano B.**
27	Bianchino (Vignoli) (mis)		**Tocai friulano B.***
34	Calora (loc syn)		**Cortese B.**
48	Cor d'Usel (loc syn)	Pignoletto (Tersi) (true), Pignoletto (Zola) (true), Pignolo (syn), Pignolo di Forlì (syn), Ribolla 30 (syn), Ribolla 31 (syn), Ribolla R23 (syn), Ribolla R3 (syn)	**Grechetto gentile B.***
50	Cornacchia (Tebano) (true)	Cornacchia (Ercolani) (true), Varon (loc syn)	**Cornacchia N.***
56	Dorata di Fontevivo (loc syn)		**Dorona B.**
57	Duraguzza (loc syn)		**Mornasca N.**
59	Famoso (Bragagni) (true)	Famoso (Conventino) (true)	**Famoso B.***
61	Festasio (true)		**Festasio N.***
63	Fogarina di Gualtieri (true)		**Fogarina N.***
70	Frattini (loc syn)		**Piedirosso N.**
72	Gialmona (mis)		**Lambrusco Marani N.***
75	Grattacoppa (loc syn)		**Uva del Tundè N.***
76	Gravarena (loc syn)	Stciucaera rossa (loc syn)	**Erbanno N., Rossara N., Schiava N.**
79	Lambrusco di Fiorano (syn)		**Lambrusco del Pellegrino N.***
80	Lambrusco picol ross (loc syn)		**Terrano N.***
81	Lanzesa (true)		**Lanzesa B.***
83	Liedga (centenaria "La Palazza") (syn)		**S. Anna di Lipsia B.**

84	Lisora (syn)		**Liseiret B. (Heunisch weiss, Gouais blanc)**
88	Malvasia aromatica di Parma (Casalini) (true)		**Malvasia Casalini B.***
89	Malvasia Bianca (syn)		**Malvasia bianca di Candia B. ***
93	Malvasia profumata di Parma 1 (mis)	Moscatone (loc syn)	**Moscato giallo B.**
97	Mollona (loc syn)		**Invernenga B.**
98	Moscatello (syn)		**Moscato bianco B.***
100	Moscatellone nero (mis)		**Cardinal N.**
101	Moscato nero (mis)		**Moscato d'Amburgo N.**
104	Negretta 1 (mis)	Negrettino (Sbarzalia) (mis)	**Marzemino N.***
111	Paradisa (syn)	Verdea (true)	**Verdea B.***
114	Pellegrina (Cadriano) (mis)		**Verduzzo trevigiano B.**
134	Santa Maria (true)		**Santa Maria B.***
135	Santa Maria nera (mis)		**Ciliegiolo N.***
136	Sauvignon rosso (syn)		**Centesimino N.***
139	Scarsafoglia (true)	Squarciafoglia (syn)	**Scarsafoglia B.*, Scimiscià B.***
142	Scorzamara (Rinaldi) (mis)		**Lambrusco grasparossa N.***
144	Sgavetta (true)		**Sgavetta N.***
151	Termarina bianca (syn)		**Passeretta B.***
152	Termarina rossa (true)		**Termarina N.***
153	Tonda di S. Secondo (loc syn)		**Bonamico N.**
154	Tosca (true)		**Uva tosca N.***
155	Trasforini (loc syn)		**Angela B.***
156	Trebbiano di Spagna (syn)		**Trebbianina B.***
170	Uva vacca (syn)		**Mostosa B. ***
174	Verdicchio (true)		**Verdicchio bianco B.***
176	Vernaccina (syn)		**Vernaccina B.***
177	Verrucchiese (syn)		**Veruccese B.***

B

	Accession names[a]	**Internal synonyms[a]**	**Matching non-Italian cultivars[b]**
46	Colorino (Ricci) (mis)		**Seibel 1077 (Jaeger 70 x Aramon)** (VIVC)
62	Fogarina (Tebano) (mis)	Nibiol (mis)	**Jacquez** (EVD)
91	Malvasia di Rimini (mis)		**Thrapsathiri** (EVD)
129	Rossa di Monte Castello (mis)		**Glacière** (Lacombe et al. 2012)
137	Sbebbi nero (loc syn)		**Bezoul El Khadem de Tunisie** (VIVC)
149	Stciucaera bianca (loc syn)		**Blanc des Hombes** (SVMD)
163	Uva di S. Andrea (loc syn)		**Palomino fino** (EVD) – **Listan** (VIVC)
166	Uva picciona (loc syn)		**Coarna Alba** (EVD)

[a] In brackets after accession names remarks to the accession names: syn = synonym, loc syn = local synonym, true = true name, mis = misnomer.

*Cultivar authorized to be cultivated in Emilia Romagna.

[b] Reference databases: VIVC = Vitis International Variety Catalogue, EVD = European Vitis Database, SVMD = Swiss Vitis Microsatellite Database.

Table 3. Local grape accessions from Emilia Romagna not officially registered (not included in Italian Grape Variety Catalogue), their internal synonyms, their varietal correspondence with local genetic resources reported in databases or literature (A) and unique, unreported genetic profiles (B).

A

Sample code	Accession names	Internal synonyms	Matching profiles in databases or literature[a]	Cultural relevance in Emilia Romagna[b]
8	Albanina nera		Negretta (Meglioraldi et al. 2013)	HT
11	Aleatico di S. Valentino		Aleatico di San Valentino (Meglioraldi et al. 2013)	LD
17	Basoleina	Scorzamara (Neviani)	Basoleina (Meglioraldi et al. 2013)	HT
20	Berzemino capolico	Nero di Gonzaga, Scorzamara val d'Enza	Scorzamara (Meglioraldi et al. 2013)	LD
22	Besgano rosso	Burghisana, Grillone	Besgano Nero (VIVC)	RD
29	Bottona		Tognona (VIVC)	HT
32	Bucalò		Vernassa Bianca (VIVC)	HT
36	Cargarello		Drupeggio (VIVC)	LD
37	Cavazzina		Cavazzina (Meglioraldi et al. 2013)	HT
47	Colorino (Siba Ladino)		Teinturier ad acino rotondo (IVD)	HT
52	Covra		Uva Crova (VIVC)	HT
53	Covretto	Crova, Crovarina, Plissona	Brugnera (VIVC) - Rossara (Meglioraldi et al. 2013)	HT
58	Durella		Durella (Meglioraldi et al. 2013)	HT
68	Forcella (centenaria di Imola)		Forcella (VIVC)	LD
78	Lambrusco di Corbelli		Lambrusco di Corbelli (Meglioraldi et al. 2013)	HT
82	Leck	Melara	Salamandola (EVD)	LD
96	Molinelli		Obi (EVD)	LD
122	Redga		Retica (VIVC)	HT
140	Sconosciuta di Castellarano		Sconosciuta di Castellarano (Meglioraldi et al. 2013)	HT
168	Uva rosa (Agnoletti)		Angelo Pirovano (I.P. 2) (EVD)	HT

B

	Accession names	Internal synonyms	Matching profiles in national and international databases or the literature[a]	Cultural relevance in Emilia Romagna[b]
1	Albana del paniere	Caveccia, Caveccia (Sant'Andrea), Cavecia (Bordone)	no match	LD
4	Albana nera (Tebano)		no match	HT
5	Albana rossa		no match	HT
12	Angela		no match	LD
13	Balsamina		no match	LD
14	Balzamino		no match	HT
16	Basgana		no match	HT
18	Bermestone	Brumesta, Cornona, Pargulona	no match	RD
19	Bertinora	Rossola di Bertinoro	no match	LD
21	Besgano bianco		no match	LD
24	Bianchetta di Bacedasco		no match	LD
25	Bianchetta di Diolo		no match	LD
28	Biondello		no match	HT
31	Bsolla		no match	HT
35	Canino	Verdetto	no match	LD

41	Ciocca (Plessi)	Uva ciocca	no match	HT
42	Ciocca (Tebano)		no match	HT
43	Ciocchereella	Uva aceto	no match	HT
44	Ciurlese		no match	HT
64	Fogliona		no match	HT
65	Forcella (Bordone)		no match	LD
67	Forcella (Tedeschini)	Forcella (Tebano)	no match	LD
69	Fortana CAB1	Uva d'oro 1	no match	LD
73	Giottina		no match	HT
74	Graplen		no match	HT
85	Madalona		no match	HT
86	Maligia (Monari)	Maligia (Tebano)	no match	LD
90	Malvasia Bolognese		no match	HT
103	Mostarino		no match	HT
113	Pellegrina (Bonfatti)		no match	LD
115	Pignoletto (Rubini)		no match	HT
121	Prunella		no match	LD
125	Ribolla R17	Vernaccia	no match	HT
127	Ribolla R24		no match	HT
130	Rossara		no match	HT
131	Rossiola	Uva rosa, Uva tosca (Tebano)	no match	LD
133	Rossola	Scacco	no match	HT
145	Simonina (Cadriano)	Simonina (Rinaldi)	no match	LD
147	Spaltarina		no match	HT
162	Uva del prato		no match	HT
164	Uva morta		no match	HT
165	Uva nebbia		no match	HT

[a] Reference database: VIVC = Vitis International Variety Catalogue, EVD = European Vitis Database, IVD = Italian Vitis Database.

[b] HT, highly threatened (on farm or *ex situ* conservation); LD, local diffusion; RD, regional diffusion.

Supplemental data Captions

Supplemental Table 1. Genetic profiles at 10 nSSR loci (alleles size in bp) of the 122 unique genotypes.

sample code	accession	VVMD5	VVMD5	VVMD7	VVMD7	VVMD25	VVMD25	VVMD27	VVMD27	VVMD28	VVMD28	VVMD32	VVMD32	VVS2	VVS2	ZAG62	ZAG62	ZAG79	ZAG79	VVMD6	VVMD6
1	Albana del paniere	225	225	233	247	241	257	180	188	236	238	253	273	133	133	204	204	244	246	190	210
2	Albana nera (Montanari)	225	231	247	253	241	257	180	190	236	236	251	273	135	151	192	204	244	258	208	210
3	Albana nera (Monte Trebbio)	225	231	247	257	241	243	182	188	236	238	259	273	133	155	194	204	244	248	200	210
4	Albana nera (Tebano)	225	239	247	253	243	257	184	193	230	236	271	273	133	155	192	204	244	250	190	208
5	Albana rossa	225	225	233	247	243	257	184	184	236	246	253	273	133	143	192	204	250	250	190	208
6	Albanella (Cadriano)	225	231	249	253	243	257	178	182	246	250	251	273	133	143	194	200	244	250	200	210
7	Albanella (Tellarini)	225	237	239	253	243	243	184	193	238	238	251	253	133	133	194	200	248	250	200	200
8	Albanina nera	231	239	239	253	243	257	184	184	230	262	253	273	133	143	192	194	244	250	208	210
9	Aleatico (Tebano)	225	227	239	249	251	257	178	193	238	248	265	273	133	135	186	196	248	254	190	210
11	Aleatico di S. Valentino	225	235	249	253	251	257	178	180	236	270	265	273	133	135	186	192	254	258	208	210
12	Angela	227	231	249	253	257	265	178	182	238	260	241	253	133	151	200	200	244	258	200	208
13	Balsamina	227	231	247	263	257	257	180	184	246	260	251	263	135	151	194	196	246	250	208	210
14	Balzamino	225	231	247	247	243	259	180	188	236	270	251	253	133	135	194	204	244	258	190	210
15	Barbesino	231	245	249	263	243	251	180	193	236	238	253	257	133	155	194	200	250	258	208	210
16	Basgana	231	231	249	253	251	257	180	188	236	236	243	251	135	151	192	194	250	258	200	208
17	Basoleina	227	231	247	253	243	269	182	188	230	260	241	263	133	143	194	204	246	250	192	202
18	Bermestone	231	239	243	243	241	243	178	184	236	260	251	253	133	145	188	188	248	248	208	208
19	Bertinora	225	235	247	247	243	265	184	193	236	236	253	263	145	151	192	194	250	254	210	210
20	Berzemino capolico	225	237	247	257	243	257	184	193	246	266	263	273	135	155	194	196	242	250	208	208
21	Besgano bianco	225	227	233	247	241	257	178	193	236	260	251	273	133	135	194	204	236	250	208	210
22	Besgano rosso	227	239	233	247	251	257	184	193	236	260	251	273	135	151	196	204	250	250	208	208
23	Bianca toscana	227	227	233	233	257	257	178	184	236	248	241	265	135	143	196	204	250	254	208	208
24	Bianchetta di Bacedasco	225	227	247	249	241	243	178	188	246	260	263	273	133	133	200	204	244	246	208	210
25	Bianchetta di Diolo	225	225	239	239	257	269	184	188	248	248	241	251	145	145	186	196	250	250	190	208
26	Bianchino	225	225	239	249	243	243	182	188	246	260	251	273	135	143	188	190	238	244	208	208
27	Bianchino (Vignoli)	227	237	239	257	243	251	184	193	236	250	241	257	133	151	188	194	250	250	200	208
28	Biondello	225	225	249	253	259	265	178	178	238	260	253	259	143	151	200	202	248	250	200	208
29	Bottona	227	227	233	239	243	251	184	184	260	260	253	273	151	155	196	204	248	250	190	208
31	Bsolla	225	239	247	253	257	265	184	184	236	238	253	273	135	151	192	194	242	244	208	210
32	Bucalò	225	225	239	249	243	251	178	188	246	246	251	263	133	143	188	204	250	258	190	210
34	Calora	225	235	249	249	243	251	178	182	236	250	253	253	133	151	200	202	246	250	190	208
35	Canino	221	225	239	253	243	261	184	190	250	260	251	273	133	143	194	200	246	250	200	208
36	Cargarello	227	239	239	249	241	243	180	182	246	260	253	273	133	145	188	190	246	258	208	208
37	Cavazzina	225	231	247	257	241	257	184	193	236	260	253	273	143	151	194	196	250	250	200	208
41	Ciocca (Plessi)	225	225	247	253	241	257	178	184	236	260	241	251	143	151	194	200	238	250	208	210
42	Ciocca (Tebano)	225	225	243	247	241	241	178	188	236	260	263	273	133	139	188	202	244	248	190	210
43	Ciocchetella	231	245	239	239	243	251	180	193	250	260	241	257	133	151	194	196	248	258	190	200
44	Ciurlese	225	227	239	247	243	257	182	182	246	260	251	273	133	135	194	204	250	250	200	210
46	Colorino (Ricci)	231	251	239	251	239	243	190	200	230	250	241	241	133	133	194	194	244	250	200	216
47	Colorino (Silba Ladino)	235	237	239	247	251	257	188	193	230	236	253	273	133	151	194	196	244	250	200	208
48	Cor d'Usel	225	245	249	263	243	243	184	188	238	260	253	259	133	145	200	202	242	250	208	208
50	Cornacchia (Tebano)	231	235	239	247	243	257	184	193	246	260	241	263	133	135	194	196	244	250	200	208
52	Covra	225	235	247	247	243	257	184	184	236	260	241	253	135	145	192	196	242	250	208	210
53	Covretto	235	239	243	247	243	257	184	184	248	262	253	273	133	143	188	192	242	250	190	208
56	Dorata di Fontevivo	231	231	243	249	243	243	184	193	236	238	251	263	133	145	188	200	250	250	208	208
57	Duraguzza	225	227	239	247	243	251	180	180	236	238	251	273	133	151	194	204	250	258	190	208
58	Durella	225	231	253	253	241	243	178	193	246	246	251	251	133	133	188	194	236	250	200	208
59	Famoso (Bragagni)	225	227	239	247	241	243	178	188	230	260	265	273	133	133	188	204	242	244	208	210
61	Festasio	225	227	239	247	243	243	178	184	236	236	257	273	133	133	194	196	250	250	208	208
62	Fogarina (Tebano)	227	243	237	239	257	259	178	188	232	238	253	253	139	143	186	198	248	248	208	208
63	Fogarina di Gualtieri	227	239	233	239	243	257	184	188	230	236	251	257	133	135	194	204	246	250	200	208
64	Fogliona	225	231	249	253	241	241	178	184	250	260	241	273	139	151	200	204	238	250	190	208
65	Forcella (Bordone)	225	225	233	247	243	257	178	184	236	270	241	273	133	143	192	204	248	254	190	208
67	Forcella (Tedeschini)	225	225	245	247	243	257	184	184	236	270	273	273	133	133	192	204	248	248	190	208
68	Forcella (centenaria di Imola)	227	231	233	239	243	243	180	182	238	260	251	273	133	143	200	204	244	258	190	200
69	Fortana CAB1	231	231	247	253	241	257	190	193	236	246	253	273	143	151	192	196	244	250	190	208
70	Frattini	231	235	249	263	241	265	188	188	238	260	241	257	143	151	194	202	258	258	208	208
72	Gialmona	237	239	233	239	251	257	184	188	230	236	257	273	135	151	196	204	246	250	208	210
73	Giottina	231	245	247	249	243	251	184	184	236	238	259	273	133	157	196	204	250	250	190	210
74	Graplen	225	225	247	253	243	257	180	188	236	262	253	263	133	133	192	194	244	256	208	210
75	Grattacoppa	227	231	247	253	241	257	180	190	236	236	253	273	133	135	192	204	248	258	208	210
76	Gravarena	225	233	239	253	241	257	178	184	246	248	251	273	133	143	194	196	236	250	190	200
78	Lambrusco di Corbelli	227	237	239	263	243	257	184	184	224	238	257	257	151	155	196	202	238	256	190	208
79	Lambrusco di Fiorano	225	231	239	253	257	259	184	184	236	262	253	263	143	155	188	192	242	250	190	200
80	Lambrusco picol ross	225	227	247	249	243	257	188	188	220	236	251	273	135	155	192	194	238	250	200	208
81	Lanzesa	225	239	233	247	241	257	180	188	262	270	253	273	135	139	194	204	246	258	190	210
82	Leck	227	231	239	249	251	257	188	193	238	246	257	273	133	133	188	200	250	258	208	208
83	Liedga (centenaria "La Palazza")	227	235	247	247	243	251	184	184	236	248	253	263	145	155	192	194	238	250	210	210
84	Lisora	233	239	239	249	241	257	178	180	230	248	251	273	133	143	196	204	236	242	190	210
85	Madalona	225	231	253	263	257	257	184	190	238	266	241	253	135	155	200	204	242	250	210	210
86	Maligia (Monari)	225	231	249	249	243	257	178	193	236	260	257	273	133	135	190	202	250	256	208	208
88	Malvasia aromatica di Parma (Casalini)	227	235	233	247	251	257	178	184	248	260	241	265	133	135	196	196	242	254	208	208
89	Malvasia bianca	225	237	249	263	243	257	184	193	248	250	259	259	133	143	200	202	238	250	208	208
90	Malvasia bolognese	225	227	249	249	243	251	178	184	248	270	251	273	133	133	200	204	250	254	200	210
91	Malvasia di Rimini	237	245	239	247	241	243	178	186	236	246	251	273	143	145	188	196	250	256	190	208
93	Malvasia profumata di Parma 1	227	239	239	249	243	257	178	178	238	248	259	273	133	143	186	188	248	254	208	208
96	Molinelli	235	239	253	263	243	257	184	190	248	260	253	253	133	143	192	194	242	250	190	208
97	Molliona	225	233	239	243	257	257	182	188	236	260	259	273	135	147	188	194	242	246	200	208
98	Moscatello	227	235	233	249	243	251	178	193	248	270	265	273	133	133	186	196	250	254	208	210
100	Moscatellone nero	225	235	249	249	257	257	178	184	246	270	253	273	135	135	186	186	250	254	208	210
101	Moscato nero	231	237	247	249	251	257	178	184	238	246	273	273	135	149	186	192	238	254	208	210
103	Mostarino	225	231	247	249	241	245	184	184	238	270	253	263	133	155	186	200	238	250	208	210
104	Negretta 1	225	231	239	263	243	257	184	188	236	238	241	263	133	133	194	194	242	250	200	210
111	Paradisa	233	239	247	247	241	257	178	188	238	262	251	273	133	133	194	204	244	248	208	208
113	Pellegrina (Bonfatti)	231	231	239	257	241	243	180	184	236	270	271	273	151	155	194	196	250	258	200	208
114	Pellegrina (Cadriano)	225	227	247	263	257	269	178	188	230	236	241	273	143	151	194	204	250	258	208	210
115	Pignoletto (Rubini)	225	225	247	249	243	243	180	184	260	270	263	273	133	139	190	192	248	256	208	208
121	Prunella	225	235	239	243	243	243	180	184	230	246	257	273	133	133	188	196	242	258	190	208
122	Redga	231	231	239	243	243	243	178	184	236	236	257	263	145	155	188	196	248	248	208	208
125	Ribolla R17	225	227	249	253	257	257	190	193	246	250	251	263	143	155	200	200	246	250	200	208
127	Ribolla R24	225	225	239	249	243	243	178	190	250	260	251	253	133	133	194	200	246	250	200	208
129	Rossa di Monte Castello	231	239	243	243	243	257	178	184	248	260	251	253	135	145	188	188	248	250	208	208
130	Rossara	225	239	247	253	241	257	188	188	238	238	253	273	133	143	192	204	244	244	208	208
131	Rossiola	225	225	247	247	243	257	184	193	246	260	253	265	135	155	188	196	250	250	208	210
133	Rossola (Tebano)	225	245	239	239	241	243	184	193	238	238	257	273	133	133	188	196	248	250	190	208
134	Santa Maria	225	245	263	263	241	251	178	193	238	260	253	275	133	133	194	194	250	258	208	210
135	Santa Maria nera	225	235	247	263	243	243	178	182	236	248	253	253	133	133	194	204	244	258	208	210
136	Sauvignon rosso	225	225	249	263	243	243	178	178	246	260	253	253	133	133	186	194	254	258	208	210
137	Sbebbi nero	237	237	239	249	241	247	178	180	246	260	257	261	133	143	188	188	250	250	208	210
139	Scarsafoglia	225	235	239	253	243	251	178	188	238	246	239	263	133	133	188	200	250	258	208	210
140	Sconosciuta di Castellarano	227	231	257	257	241	251	180	190	236	236	263	273	151	151	194	196	250	258	200	210
142	Scorzamara (Rinaldi)	231	231	239	249	243	257	184	188	220	246	241	263	133	133	194	200	244	244	200	208
144	Sgavetta	231	239	239	247	241	257	184	184	236	262	241	253	133	135	196	196	242	242	190	210
145	Simonina (Cadriano)	235	245	247	263	243	257	184	188	238	260	241	257	133	151	194	196	244	250	208	208
147	Spaltarina	231	231	239	247	241	257	182	188	236	236	241	253	133	151	200	204	244	248	202	210
149	Stoiucaera bianca	225	225	247	247	241	241	184	193	236	246	263	273	133	139	204	204	238	250	190	210
151	Termarina bianca	235	239	249	253	251	257	184	190	246	250	253	273	143	143	200	200	246	258	208	210
152	Termarina rossa	225	227	239	247	241	243	182	188	238	260	253	273	133	133	194	204	244	244	200	210
153	Tonda di S. Secondo	225	227	253	263	243	257	182	184	236	238	253	273	133	135	200	202	238	244	208	208
154	Tosca (Rinaldi)	231	231	247	257	241	243	180	188	236	236	241	273	151	155	194	204	248	258	200	210
155	Trasforini	225	231	247	247	241	243	182	184	238	248	251	263	133	133	194	204	246	250	208	210
156	Trebbiano di Spagna	225	231	247	263	257	257	178	188	230	238	241	251	143	143	194	194	250	250	190	208
162	Uva del prato	225	231	247	263	251	257	184	190	246	260	251	263	133	135	194	204	242	246	210	210
163	Uva di S. Andrea	227	239	239	249	243	243	184	193	238	250	257	259	133	145	188	194	250	256	200	208
164	Uva morta	225	233	233	253	241	269	180	184	230	238	241	257	133	143	196	200	238	258	208	210
165	Uva nebbia	225	227	239	263	241	243	184	190	238	250	249	253	133	133	194	202	246	250	200	208
166	Uva picciona	237	245	239	239	241	251	178	180	236	238	265	273	133	143	188	188	250	258	208	208
168	Uva rosa (Agnoletti)	231	235	247	247	257	257	184	184	220	246	241	273	135	143	192	204	238	250	208	208
170	Uva vacca	225	245	243	247	243	243	188	188	236	260	263	273	133	145	188	196	250	256	190	208
174	Verdicchio	227	239	239	247	243	243	178	184	238	260	253	257	133	155	196	196	248	256	190	190
176	Vernaccina	225	235	239	239	243	257	190	193	238	260	253	257	133	155	194	196	246	248	190	200
177	Verrucchiese	225	227	239	247	241	243	184	190	238	260	253	273	133	133	196	204	246	250	200	210

Supplemental Table 2. Genetic diversity statistics obtained from evaluating 122 unique genotypes with 10 nSSR markers.

SSR marker	Number of alleles	H_{obs}[a]	H_{exp}[b]	PIC[c]	F(Null)[d]
VVMD5	11	0.779	0.795	0.766	0.01
VVMD7	11	0.803	0.830	0.804	0.0118
VVMD25	11	0.787	0.746	0.702	-0.0286
VVMD27	9	0.811	0.815	0.789	0.0026
VVMD28	13	0.869	0.852	0.831	-0.0115
VVMD32	14	0.902	0.839	0.817	-0.0432
VVS2	9	0.746	0.751	0.722	0.0073
ZAG62	10	0.861	0.851	0.830	-0.0093
ZAG79	10	0.828	0.819	0.799	-0.013
VVMD6	7	0.746	0.691	0.642	-0.0383
Average	10.5	0.8132	0.7989	0.7702	-0.01122

[a] Heterozigosity observed; [b]Heterozigosity expected; [c] Polymorphic information content; [d] Null allele frequencies.