

Molecular characterization of table grape varieties preserved in the Rancho de la Merced Grapevine Germplasm Bank (Spain)

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Summary

A collection of 317 table-grape accessions preserved in the *Vitis* Germplasm Bank at the Rancho de la Merced (IFAPA, Jerez de la Frontera, Spain) were genotyped at 20 microsatellite loci. A total of 264 different genotypes were obtained. Among them, 66 are presented for the first time. Twenty-one accession names are considered new synonyms, fourteen homonyms and 48 can be considered as "denomination mistakes" in the Rancho de la Merced collection.

Key words: table grape; grapevine varieties; germplasm bank; *Vitis vinifera*; microsatellite markers; synonymies.

Introduction

Grapevine (*Vitis vinifera* L.) varieties show a wide genetic diversity. This is due to its long history of cultivation (OLMO 1995, MCGOVERN 2003) and their vegetative propagation enabling conservation of cultivars over a long period of time (THIS *et al.* 2011). The number of cultivars available today is estimated to be between 6,000 and 10,000 (GALET 2000, MAUL 2008). They are maintained in germplasm banks distributed worldwide. Currently the *Vitis* International Variety Catalogue (IVVC, www.vivc.de) database describes around 23,000 cultivars (*Vitis vinifera* and interspecific crossings), breeding lines and *Vitis* species, existing in grapevine repositories and/or described in bibliography (MAUL 2016). However, accurate information of the existent genetic diversity is hampered by complex synonymy, homonymy and misnaming, the number of different varieties being thus much lower. In this way, LAUCOU *et al.* (2011) analyzed a total of the 4370 *Vitis vinifera* accessions in Vassal, the worldwide largest grapevine collection, with 20 SSR markers and obtained 2.739 different SSR genotypes.

The Rancho de la Merced Germplasm Bank was established in 1940 in Jerez de la Frontera (Cádiz, Spain) and it is considered one of the largest grapevine collections in the world. Together with El Encín (Alcalá de Henares, Madrid, Spain) they are the main Spanish grapevine collections

(BUHNER-ZAHARIEVA *et al.* 2010). The Rancho de la Merced Germplasm Bank preserves 2683 entries corresponding to 1,376 *Vitis vinifera* accessions, 104 rootstocks, 16 *Vitis* species, 53 interspecific hybrids, 1064 new breeding lines (GARCÍA DE LUJÁN and LARA 1997) and 70 *Vitis vinifera* ssp *sylvestris* accessions. Identification of this plant material is crucial and represents the first step in germplasm management.

Simple sequence repeats (SSR) or microsatellites sites are excellent markers for grapevine characterization (SEFC *et al.* 2001) because of their high level of polymorphism, codominant nature and high reproducibility compared to other markers. Since about twenty years many articles including genetic profiles were published and various SSR-marker databases were put online, serving cultivar identification (LOPES *et al.* 1999, MARTÍN *et al.* 2003, VANTINI *et al.* 2003, IBÁÑEZ *et al.* 2009, CRIPRIANI *et al.* 2010, LAUCOU *et al.* 2011, LACOMBE *et al.* 2013, UPADHYAY *et al.* 2013 and MARSAL *et al.* 2016). However, there are still large germplasm collections which genetic profiles have not been characterized and are not published. This is the case of the collection at Rancho de la Merced.

Here we report the genetic characterization of 317 table-grape accessions conserved at Rancho de la Merced germplasm bank using 20 SSR loci. The results obtained have been compared with genotypes published in other collections characterized so far identifying sixty-six new unpublished genotypes. In addition the study uncovers new synonyms and homonyms in table grapes. This analysis is the first step for the rationalization and better management of the germplasm preserved at Rancho de la Merced.

Material and Methods

Plant material: Plant materials were obtained from the Rancho de la Merced Germplasm Bank, located in Jerez de la Frontera (Cádiz, Spain). A total of 634 plants corresponding to 317 accessions of table-grape were analyzed (two plants per accessions) for minimizing mistakes caused by the technique. The Table list accession number, accession name, berry color, origin and country according to the

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Table

Table grape accessions analyzed in this study

Database code ESP074-xx	Accession name	Berry color ^a	Variety number ITVC	Prime name ITVC	Origin ^b	Country ^c	Remarks to the accession name
3	Actoni Macerón	B	122	Afus Ali	EE	ESP	S
4	Admirable de Courtiller	B	68	Admirable De Courtiller	CAM	ESP	TR
5	<i>Agostenga rosa</i>	N	22845	Erlenbacher Schwarz	EE	ESP	M
6	Ahmeur bou ahmeur	N	140	Ahmeur bou Ahmeur	EE	ESP	TR
7	<i>Ai Izum Beli</i>	B	6143	Khalili Deli	EE	ESP	M
8	Alba	B	219	Alba	INTA	ARG	TR
9	Alberta	B	244	Alberta	EE	ESP	
10	Aledo	B	262	Aledo	CAM	ESP	TR
12	<i>Aledo Real</i>	B		does not match aledo (ITVC-No_262)	EE	ESP	H
14	Alfonso Lavallée x Ferral	B	17590	Alfonso Lavallee X Ferral	CAM	ESP	
15	Almería	B	8716	Ohanes	Davis	USA	S
17	Angelina	N	140	Ahmeur bou Ahmeur	EE	ESP	S
18	Angelita	N	140	Ahmeur bou Ahmeur	EE	ESP	NS
19	Anna María	B	487	Annamaria	CAM	ESP	TR
20	Apesorgia nera	N	508	Apesorgia Nera	EE	ESP	
23	ARG	N	4452	Argentina	Bari	ITA	TR
24	Arizul	B	607	Arizul	Bari	ITA	
25	Arturo Marescalchi	N	660	Arturo Marescalchi	EE	ESP	TR
26	Atalaya	B	735	Atalaya	CAM	ESP	
27	Attilio Raggioneri	B	757	Attilio Raggioneri	EE	ESP	
28	Augusta	B	771	Augusta	EE	ESP	TR
29	*Auguste Suisse	B	774	Augusta Luise	EE	ESP	AS
30	<i>Aurora</i>	B		does not match Aurora INTA (ITVC-No_783), Aurora (IAC77526) (ITVC-No_17009) and Aurora (Pirovano 100) (ITVC-No_782)	CAM	ESP	H
31	Aurora	B	783	Aurora Inta	INTA	ARG	TR
32	Balbal	B	928	Balbal	EE	ESP	
33	Barbaleu	N	967	Barbaleu	EE	ESP	TR
34	*Barbarrosa	N	3425	Danugue	EE	ESP	M
35	Baresana	B	6414	Korithi Aspro	Zaragoza	ESP	S
36	Barlinka	N	41916	Barlinka Faux	EE	ESP	NS
37	Basile Logothetis	B	1023	Basile Logothetis	EE	ESP	TR
38	Bayad	B	1048	Bayad	CAM	ESP	TR
39	Beba	B	22710	Beba	CAM	ESP	TR
40	Beba	B	22710	Beba	TC	ESP	TR
41	Beba	B	22710	Beba			TR
42	Beba de Palos	B	22710	Beba	CAM	ESP	S
43	Beba de Huelva	B	22710	Beba	CAM	ESP	S
44	Beba de Jaén	B	22710	Beba	CAM	ESP	S
45	Beba de Jerez	B	22710	Beba	CAM	ESP	S
46	Bicane	B	1341	Bicane	CC	ESP	TR
47	Big Perlón	N	17811	Big Perlon			
48	Black Alicante	N	16598	Black Alicante	EE	ESP	TR
49	Black Currant	N	6410	Korinthiaki	EE	ESP	S
50	<i>Black Magic</i>	B	17452	Black Monukka			M
51	<i>Black prince</i>	N	7832	Milton	EE	ESP	M
52	Black rose	N	1407	Black Rose	A2001	ESP	TR
53	Black rose	N	1407	Black Rose	EE	ESP	TR
54	<i>Black rose</i>	N					M**
55	<i>Black seedless</i>	N	12051	Sultanina	INTA	ARG	M
56	<i>Blanca de Foster's</i>	B	3509	Delight	CAM	ESP	M
57	Blanca Gordal	B	24550	Corazon De Cabrito	CC	ESP	S
58	Blanca superior parral	B	22710	Beba	EE	ESP	S
60	Blush seedless	N	1472	Blush Seedless	LA	ESP	TR
61	Bogni 8	N	1512	Bogni 8	EE	ESP	
63	Bronx seedless	N	1694	Bronx Seedless	LA	ESP	TR
75	Burra blanca	B	157	Airen	EE	ESP	S
76	<i>California</i>	N		does not match California (ITVC-No_6860)	INTA	ARG	H
80	Canner seedless	B	2055	Canner Seedless	EE	ESP	TR
81	Cantarera	B	15566	Cantarera	CAM	ESP	

Table, continued

Database code ESP074-xx	Accession name	Berry color ^a	Variety number /ITVC	Prime name /ITVC	Origin ^b	Country ^c	Remarks to the accession name
85	Carina	B	4450	Carina	Bari	ITA	TR
86	<i>Carina</i>	N		does not match Carina (ITVC-No_4450)			H
87	Castellano morado	N	7900	Molinera	CAM	ESP	S
88	*Catalanesca blanca	B	2337	Catalanesca	EE	ESP	NS
89	Cavus	B	10196	Chaouch Blanc	EE	ESP	S
90	Centenial seedless	B	2380	Centennial Seedless	INTA	ARG	TR
91	<i>Chaouch</i>	B	2380	Centennial Seedless	EE	ESP	M
92	Chaouch rose	N	2507	Chaouch Rozovyi	EE	ESP	S
93	Chasselas apyrene	B	2497	Chasselas Sans Pepins	EE	ESP	S
94	*Chasselas blanca	B	2473	Chasselas Blanc	Zaragoza	ESP	S
101	Chinchillana	N	12350	Tempranillo Tinto	EE	ESP	S
102	Christmas rose	N	2624	Christmas Rose	INTA	ARG	TR
103	Christmas rose	N	4141	Flame Seedless			M
105	<i>Circe</i>	B	1421	Blanc D'ambre	EE	ESP	M
106	Ciruela roja	N	2686	Ciruela Roja	EE	ESP	TR
107	Colgadero	N	9849	Quiebratinajas Tinto	EE	ESP	S
108	Colgar roja	N	2761	Colgar Roja	EE	ESP	TR
110	<i>Conca D'oro</i>	N		does not match Conca D'oro (ITVC-No_2799)	EE	ESP	H
111	Conegliano 120	B	14393	Conegliano 120	Conegliano	ITA	TR
112	Conegliano 199	N	15758	Conegliano Precoce	Conegliano	ITA	S
113	Conegliano 213	B	15727	Conegliano 213	Conegliano	ITA	
114	Conegliano 218	N	14395	Conegliano 218	Conegliano	ITA	TR
117	Corinto negro	N	6410	Korinthiaki	EE	ESP	S
118	<i>Cornichón blanco</i>	B	24538	Kontegalo	EE	ESP	M
119	<i>Cornichón violeta</i>	N	5423	Hora	EE	ESP	M
121	Crystal	B	3273	Crystal	EE	ESP	
122	Dabcumi	B	3309	Dabouki	EE	ESP	TE
123	Dalmaso III-33	N	3321	Dalmaso 3-33	EE	ESP	TR
124	Dalmaso VI-3	B	3897	Emilia	EE	ESP	S
125	Dalmaso VI-6	N	3332	Dalmaso 6- 6	EE	ESP	S
126	Dalmaso XI-20	N	3368	Dalmaso 11-20	EE	ESP	S
127	Danam	B	3418	Danam	INRA	FRA	TR
128	Danlas	B	3418	Danam	INRA	FRA	M
129	Danuta	B	16386	Danuta	INTA	ARG	TR
130	<i>Darkaia nera</i>	N		does not match Coarna Neagra (ITVC-No_2726)	EE	ESP	H
131	Datal	B	3423	Danlas	INRA	FRA	M
133	Dattier noir	N	3438	Dattier Noir	EE	ESP	TR
134	Dawn seedless	B	3467	Dawn Seedless	LA	ESP	TR
135	De cilindro	B	3470	De Cilindro	EE	ESP	
137	Del Barco	B	8716	Ohanes	EE	ESP	NS
138	Delhro	N	3504	Delhro	INTA	ARG	TR
139	Delight	B	3509	Delight	EE	ESP	TR
140	Delight	B	3509	Delight	LA	ESP	TR
141	Delizia di Vaprio	B	3510	Delizia Di Vaprio	CAM	ESP	TR
142	Delizia di Vaprio	B	3510	Delizia Di Vaprio			TR
145	Dominga	B	4985	Dominga	EE	ESP	TR
149	Dongine	B	24197	Dongine	EE	ESP	
151	*Dorona di Venecia	B	3664	Dorona Veneziana	EE	ESP	S
152	Doroni Maceron	N	3665	Doroni Maceron	CAM	ESP	
153	Duc de Magenta	N	3703	Duc De Magenta	EE	ESP	TR
154	<i>Duchess de Buccleugh</i>	B	8192	Muscat Bifere	EE	ESP	M
155	Early Cardinal	N	14398	Cardinal Early	A2001	ESP	S
156	Early muscat	B	3801	Early Muscat	Davis	USA	TR
157	*El Farrayali	N	3857	El Farrayali	EE	ESP	AS
158	El Gouz	B	3858	El Gouz	EE	ESP	TR
159	Elettra	N	17582	Elettra	EE	ESP	
161	Emerald seedless	B	3895	Emerald Seedless	EE	ESP	TR
165	<i>Emperatriz</i>	N		does not match Emperatriz (ITVC-No_15452)			H
166	Emperor	N	4022	Exotic	EE	ESP	M
170	Exotic	N	4022	Exotic	LA	ESP	TR
172	Fantasia	N	16016	Fantasy Seedless	INTA	ARG	NS
176	Fiesta	B	4126	Fiesta	LA	ESP	

Table, continued

Database code ESP074-xx	Accession name	Berry color ^a	Variety number /ITVC	Prime name /ITVC	Origin ^b	Country ^c	Remarks to the accession name
177	Flame seedless	N	4141	Flame Seedless	A2001	ESP	TR
178	Flame seedless	N	4141	Flame Seedless			TR
179	Flame Tokay	N	140	Ahmeur bou Ahmeur	EE	ESP	S
180	<i>Flora</i>	N		does not match Flora (ITVC-No_15218)	GB	ESP	H
181	Fondo de Orza	B	17469	Fondo de Orza	EE	ESP	TR
182	Foster's White seedling	B	122	Afus Ali	Milán	ITA	M
183	Frakhtental	N	10823	Schiava Grossa	EE	ESP	S
184	Fraula kokkini	N	5350	Henab Turki	EE	ESP	S
185	Fumat	N	4289	Fumat	EE	ESP	
186	Fusca	N	4293	Fusca	EE	ESP	
188	Gallurazeni di Damasco	B	4357	Gallurazeni di Damasco	EE	ESP	TR
189	Gateta	N	4480	Gateta	EE	ESP	
190	General de la Marmona	B	4756	General de la Marmora	EE	ESP	TR
191	Glaciere	N	4819	Glaciere	EE	ESP	TR
192	Gold	B	4997	Gold	EE	ESP	TR
193	Golden Hill	B	8758	Olivette Blanche	EE	ESP	S
195	Gradisca	B	4936	Gradisca	EE	ESP	TR
196	Graziella I	B	4954	Graziella I	EE	ESP	
198	Greg	B	4975	Greg	EE	ESP	TR
199	<i>Gros Colman</i>	B	2726	Coarna Neagra	CAM	ESP	M
200	Gros Marq	N	3402	Black Morocco	EE	ESP	M
204	Ignea	N	5490	Ignea	EE	ESP	TR
205	<i>Imperial negra</i>	N	22978	Planta Mula	EE	ESP	M
207	<i>Interlaken seedless</i>	B	12051	Sultanina	PSM	ESP	M
208	<i>Inzolia nera</i>	N		does not match Inzolia Nera (ITVC-No_5533)	EE	ESP	H
211	Italia x Sultanina V-6	B	5727	Nedeltcheff Magvatlana	EE	ESP	TR
212	Italia x Sultanina VI-4	B	5728	Nedeltcheff Vi-4	EE	ESP	TR
213	Jantar	B	5669	Jantar	EE	ESP	TR
214	Japinkay	B	8182	Muscadelle	EE	ESP	S
215	Jaumet	B	5670	Jaoumet	EE	ESP	S
220	July Muscat	B	5855	July Muscat	Davis	USA	
221	Keuka	N	6131	Keuka	EE	ESP	
222	<i>King's Ruby</i>	N	8436	Negra Dorada	VO	ESP	M
223	Kishmishi	N	5477	Ichkimar	A2001	ESP	S
224	*Kishmish blanco	B	6269	Kishmish Belyi Kruglii	A2001	ESP	NS
225	*Kyoha	N			INTA	ARG	
226	Lady Downe's seedling	N	6628	Lady Downe's Seedling	EE	ESP	TR
227	Lasina	N	6761	Lasina	EE	ESP	TR
229	<i>Lival</i>	N		does not match Lival (ITVC-No_6865)	INRA	FRA	H
230	Local Black	N	24975	Local Black	EE	ESP	
231	Local White Xynisteri	B	704	Xynisteri	EE	ESP	S
232	Lombardía	N	6894	Lombardia	EE	ESP	TR
234	Lord Rothermere	N	12367	Teresa Pirovano	EE	ESP	
235	Luglienga blanca	B	6982	Luglienga Bianca	CAM	ESP	TR
236	Luisa blanca	B	22709	Forcallat Blanca	EE	ESP	S
238	Madeleine Clement	B	22739	Ragol	EE	ESP	M
239	Madina	B	16381	Madina	INTA	ARG	TR
241	Malagueña moscatel	N	140	Ahmeur bou Ahmeur	EE	ESP	NS
242	Malvina	B	4432	Rutilia	INTA	ARG	S
243	Mantuo de Granada	B	22710	Beba	EE	ESP	S
245	Marieta	B	7410	Marieta	EE	ESP	
246	*Mario rosa	N			EE	ESP	
247	Marroo seedless	N	15632	Marroo Seedless	Camberra	AUS	TR
248	<i>Marsigliana</i>	N	1315	Bezoul El Khadem de Tunisie	EE	ESP	M
250	Mawrub	N	7539	Mavrud	EE	ESP	S
251	Merbein seedless	B	7637	Merbein Seedless	Camberra	AUS	TR
252	Meslier Hatif	B	7675	Meslier Petit	EE	ESP	NS
253	Micheli di Palieri	N	7704	Michele Palieri	INTA	ARG	AS
254	Micheli di Palieri	N	7704	Michele Palieri			AS
255	Mistress Hall	N	9263	Pince's Black	EE	ESP	S
256	Molinerá	N	7900	Molinerá	CAM	ESP	TR
257	Mondina	N	7921	Mondeuse Noire	CAM	ESP	NS

Table, continued

Database code ESP07/4-xx	Accession name	Berry color ^a	Variety number /TVC	Prime name /TVC	Origin ^b	Country ^c	Remarks to the accession name
259	More	N	40041	More	EE	ESP	
261	Moscatel de Encinacorba	B	12633	Trepat	EE	ESP	M
263	<i>Moscatel negro</i>	N		does not match Listan Prieto (ITVC-No_6860) and Muscat Hamburg (ITVC-No_8226)	CAM	ESP	H
264	Moscatel negro	N	24609	Breval Negro	EE	ESP	M
265	<i>Moscatel negro de Valencia</i>	N	8241	Muscat Of Alexandria	EE	ESP	M
266	Moscatel ruso	B	8295	Muskat Usbekistanskii	A2001	ESP	S
267	<i>Moscato di Caneli</i>	B		does not match Muscat A Petit Grains Blancs (ITVC-No_8193)	EE	ESP	H
268	Moscato di Terracina	B	8053	Moscato Di Terracina	EE	ESP	TR
269	Moscato Gustav Szauter	B	12135	Szauter Gusztav	EE	ESP	NS
271	Moscato rosa	N	8057	Tamjanika Crna	SMAA	ITA	S
272	Moscatuel	B	8059	Moscatuel	Bari	ITA	TR
273	Moscatuel	B	8059	Moscatuel	INTA	ARG	TR
274	Mulata	B	13075	Vijiriega Comun	EE	ESP	M
275	Muñeca	N	14943	Icod de los Vinos	EE	ESP	NS
278	Muscat de Hamburg	N	8226	Muscat Hamburg	Zaragoza	ESP	TR
279	Muscat Julius	N	7503	Mathiasz Janosne	EE	ESP	NS
280	*Muscat noir de Marseille	N	8226	Muscat Hamburg	CAM	ESP	M
281	Muscat Ottonel	B	8243	Muscat Ottonel	Davis	USA	TR
282	Muscat Saint Laurent	B	8252	Muscat St. Laurent	EE	ESP	TR
283	Muscat Santa Vallier	B	8210	Muscat de St. Vallier Blanc	Davis	USA	TR
284	Naparo	N	8345	Naparo	EE	ESP	TR
287	Negra tardía	N	15609	Negra Tardia	EE	ESP	
288	*Nehelescol blanco	B	8467	Nehelescol	EE	ESP	NS
289	Nerona	N	4448	Dacari	Bari	ITA	M
290	<i>Niabell</i>	N	4985	Dominga	LA	ESP	M
291	Niger	N	8553	Niger	EE	ESP	
292	Nincusa	N	8565	Nincusa	EE	ESP	TR
293	*Noha	B	15756	Noica	Bari	ITA	M
294	Noica	N	15756	Noica	A2001	ESP	
295	Noir Hatif de Marseille	N	8585	Noir Hatif De Marseille	EE	ESP	TR
297	Ohanes	B	8716	Ohanes	CAM	ESP	TR
298	<i>Ojo de buey</i>	N		does not match Dodrelyabi (ITVC-No_3616)	EE	ESP	H
299	Olivetta nera	N	8759	Olivette Noire	EE	ESP	S
300	Olivette Barthelet	B	8757	Olivette Barthelet	EE	ESP	TR
302	Ophtalmo	N	8782	Ophtalmo	EE	ESP	TR
303	Orange Muscat	B	8221	Muscat Fleur d'Oranger	INTA	ARG	S
304	Oscari rose	B	8816	Beitamouni Rose	EE	ESP	
305	*Palestina	B	2520	Mantuo	Zaragoza	ESP	M
306	Palestina I	B	8878	Palestina I	EE	ESP	TR
308	Panse Precoce	B	11775	Sicilien	CAM	ESP	S
310	Parra de don Gregorio	N	8948	Parra de la Casa	EE	ESP	
311	Parra de la casa	N	140	Ahmeur bou Ahmeur	EE	ESP	NS
312	Pasiga	N	8964	Pasiga	Bari	ITA	TR
313	Pasiga (ARG)	N	8964	Pasiga	INTA	ARG	TR
314	Patagonia	B	40046	Patagonia	INTA	ARG	TR
315	Patricia	N	15288	Patrizia Rosa	Bari	ITA	
316	Patricia	B	4440	Patrizia Bianca	INTA	ARG	S
317	Pepita de oro	B	122	Afus Ali	EE	ESP	S
319	Perla de Csaba	B	9166	Csaba Gyoengye	CAM	ESP	S
321	Perla negra	N	9157	Perla Nera	CAM	ESP	
322	Perlón	N	9170	Perlon	INTA	ARG	TR
323	*Perlón 2	N	4448	Dacari	INTA	ARG	M
324	Perlona	B	9171	Perlona	Bari	ITA	TR
325	*Perlona 54 Pirovano	B			CAM	ESP	
326	<i>Picapoll</i>	B	16448	Cornichon Blanc	CAM	ESP	M
339	Pizzutello Moscato Biondo	B	9525	Pizzutello Moscato Biondo	EE	ESP	TR
340	Pizzutello nero	N	9524	Pizzutello Nero	VP	ESP	TR
341	Planta nova	B	9543	Planta Nova	Zaragoza	ESP	TR
342	Plovdina	N	8899	Pamid	EE	ESP	S
343	Podí	B	10139	Rodi	INTA	ARG	AS

Table, continued

Database code ESP074-xx	Accession name	Berry color ^a	Variety number /TVC	Prime name /TVC	Origin ^b	Country ^c	Remarks to the accession name
344	Poineer	N	40054	Poineer	INTA	ARG	
345	*Precoce di Malingre	B	7249	Malingre Precoce	EE	ESP	S
346	Precoce di Roma	B	9666	Precoce di Roma	EE	ESP	
347	Primus	B	9707	Primus	EE	ESP	TR
348	*Primus 7 Pirovano	B	9707	Primus	CAM	ESP	S
349	Princeps	B	9713	Princeps	EE	ESP	TR
351	*Principesa di Piamonte	B	9715	Principessa di Piemonte	EE	ESP	AS
353	Prosperi 8	B	9743	Prosperi 8	EE	ESP	
354	Prune de Cazouls	N	9791	Prune de Cazouls	EE	ESP	TR
355	<i>Prunesta nera</i>	N	20592	Achladi	EE	ESP	M
356	Queen	N	9841	Queen	EE	ESP	TR
360	Red Essex	N	3978	Essex	LA	ESP	
361	Red Globe	N	9972	Red Globe	INTA	ARG	TR
363	*Red Ohanes	N	21500	Ohanes Red	Vitis Jerez	ESP	S
364	Regina	B	122	Afus Ali	CAM	ESP	S
365	<i>Regina de Beyrouth</i>	B			EE	ESP	H
366	Reina de las Viñas	B	6350	Königin der Weingärten	CAM	ESP	S
369	Roi des Precoces	N	10165	Roi des Precoces	EE	ESP	TR
370	<i>Roja de Ragol</i>	N	22740	Imperial Roja	A2001	ESP	M
371	Rosaki	B	122	Afus Ali	Davis	USA	S
372	*Rosaki de Creta	B			INTA	ARG	
373	*Rosaki de Smirna	B	122	Afus Ali	INTA	ARG	NS
374	<i>Rosaki dorado</i>	B	3425	Danugue	CAM	ESP	M
375	Rosaki Noir Des Semi	N			EE	ESP	
376	*Rosaki x Almeria	N			EE	ESP	
379	Royal	N	349	Alphonse Lavallee	EE	ESP	S
382	*Royales tinta	N	10314	Ruby Seedless	EE	ESP	M
383	Ruby Okuyama	N	5582	Italia - Perfect Match At 20 Loci	INTA	ARG	M
384	Ruby seedless	N	10314	Ruby Seedless	A2001	ESP	TR
385	<i>Ruby seedless</i>	N	2507	Chaouch Rozovyi	Davis	USA	M
386	Ruby seedless	N	10314	Ruby Seedless			TR
388	Rutilia	B	4432	Rutilia	Bari	ITA	TR
390	San Jaime	B	4457	Garnacha Blanca	EE	ESP	NS
391	<i>Santa Magdalena</i>	B	7512	Matilde	EE	ESP	M
393	*Santur August Crisp	B	11692	Shakar Angur Tashkentskii	A2001	ESP	M
394	Scarlet	N	10809	Scarlett	EE	ESP	
395	Seedless emperor	N	3905	Emperor Seedless	Murcia	ESP	AS
397	Serna	B	23002	Serna	INTA	ARG	TR
398	<i>Servant</i>	B	5082	Gros Vert Blanc	CAM	ESP	M
399	Shami	N	11702	Shami	EE	ESP	TR
400	Sideritis	N	11780	Sideritis	EE	ESP	TR
401	Sin hueso	B	12051	Sultanina	EE	ESP	S
402	Slavjanka	B	11873	Slavjanka	EE	ESP	
404	Sovrana	B	11965	Sovrana	EE	ESP	TR
405	*Sublima	B	17812	Sublima Seedless			S
406	Sulina	B	9168	Perlette	INTA	ARG	NS
407	Sullivan	B	12048	Sullivan Blanc	CAM	ESP	S
408	Sultana Crimson	B	15622	Sultana Chrimson	LA	ESP	TR
409	Sultana moscata	B	12050	Sultana Moscata	CAM	ESP	TR
411	Sultanina	B	12051	Sultanina			TR
415	Superba	N	12083	Superba	EE	ESP	
416	*Superfrankenthal	N	12084	Superfrankental	EE	ESP	AS
417	Superior seedless	B	12087	Sugraone	LA	ESP	S
418	Superior seedless	B	12087	Sugraone			S
419	Superzibibo	B	12088	Superzibibo	EE	ESP	
420	Tarrango	N	12267	Tarrango	Camberra	AUS	TR
421	Tempranillo de Granada	B	8888	Palomino fino	EE	ESP	S
424	Thomuscat	B	12425	Thomuscat	Murcia	ESP	TR
425	Tinogastiña	N	40064	Tinogastina	INTA	ESP	
427	Tohauto	B	22710	Beba	CAM	ESP	NS
428	Trentham Black	N	22774	Bibiola	EE	ESP	M
429	Triomphe de Jaén	B	8165	Munkatsy Jozsef	EE	ESP	M

Table, continued

Database code ESP074-xx	Accession name	Berry color ^a	Variety number /IVC	Prime name /IVC	Origin ^b	Country ^c	Remarks to the accession name
431	Turki	N	12733	Turki	EE	ESP	TR
432	Ubiley	B	13347	Yubiley	EE	ESP	
434	Uva fresa	N	94	Agawam	EB	ESP	NS
435	*Uva Jijona	B			EE	ESP	
437	Victor	N	23166	Moravia dulce	EE	ESP	M
438	Victoria	B	13031	Victoria	INTA	ARG	TR
439	XE-10	B	40074	XE-10	INTA	ARG	TR
440	XE-11	B	40075	XE-11	INTA	ARG	TR
441	XE-3	N	17811	Big Perlon	INTA	ARG	NS
442	XE-4	B	40070	XE-4	INTA	ARG	TR
443	XE-5	B	4452	Argentina	INTA	ARG	NS
444	XE-7	B	40072	XE-7	INTA	ARG	TR
445	Zeini Abiad	B	13404	Zeini Abiad	EE	ESP	

^aBerry color: B: Blanc/White; N: Noir/Black/Blue.

^bOrigin: place of origin of the accession according to the passport data of the Rancho del Merced collection.

*Accessions names not included in *Vitis* International Variety Catalogue (VIVC).

Accessions names included in the *Vitis* International Variety Catalogue (VIVC) without molecular information are noted in bold font.

Accessions names with molecular profiles different from the genotypes published in the *Vitis* International Variety Catalogue (VIVC) are noted in italic font.

Abbreviations origin: EE = El Encin (Madrid); CAM = Colección antigua de la Merced; CC = Colección Cuartillos (Jerez Front.); LA = La Alberca (Murcia); A2001 = Agro2001 (Barcelona); GB = Gonzalez Byass (Jerez Frontera); SmaA = San Michele All' Adige; PSM = El Puerto de Santa María (Cádiz); VO = Viveros Orero (Castellón); EB = El Benito (Chipiona); TC = Trebujena (Cádiz); VP = Viveros Provedo.

Abbreviations accession names: TR = true names; S = synonym; H = homonym; M = misnomer; AS = alternative spelling; TE = typing error; ** (id=Emperatriz).

passport data of the Rancho del Merced collection. Variety number and prime name /IVC were added for clarification in particular with respect to various homonyms, from which some are suspected to be misnomers. Bold font highlights accessions included in the /IVC database but without a published genotype. Accession names marked with an asterisk are not registered in the /IVC. It is important to declare here the date of access to the /IVC database, as that information may change over time. Four reference cultivars ('Cabernet Sauvignon', 'Chardonnay', 'Muscat a Petits Grains Blancs' and 'Pinot Noir') were also included to compare the genetic profiles obtained with the different published databases.

Molecular analysis: DNA was extracted from young leaves collected from each accession and stored at -80 °C, using DNeasy Plant Mini Kit (Qiagen, Hilden, Germany). A genotypic characterization was performed for 20 nuclear microsatellite loci located in the 19 linkage groups of grapevine genome: VMC1b11, VMC4F3-1 (*Vitis* Microsatellite Consortium); VVMD5, VVMD7, VVMD21, VVMD24, VVMD25, VVMD27, VVMD28, VVMD32 (BOWERS *et al.* 1996, 1999); VVS2 (THOMAS and SCOTT 1993); VVIB01, VVIH54, VVIN16, VVIN73, VVIP31, VVIP60, VVIQ52, VVIV37, VVIV67 (MERCINOGLU *et al.* 2005). Two multiplex Polymerase Chain Reactions (PCR) were set up to amplify the 20 microsatellite loci. Amplification reactions were performed with an Applied Biosystems 9700 thermocycler. PCR was performed as previously described by VARGAS *et al.* (2007), with slight modification: amplifications were carried out in a 20 µL reaction mix.

Amplified products were separated in capillary electrophoresis using an automated sequencer (ABI Prism 3130, Applied Biosystems). Fluorescently labelled fragments

were detected and sized using GeneMapper v. 3.7 software (Applied Biosystems) and fragment lengths were determined with the help of internal size standards (GeneScan-500 LIZTM, Applied Biosystems).

Identification of redundant genotypes was determined by comparing microsatellite genotypes with data contained in the microsatellite grapevine databases Rancho de la Merced (JIMÉNEZ-CANTIZANO 2014), the *Vitis* Germplasm Bank (BGV) at the Finca El Encín (IMIDRA, Alcalá de Henares, Spain) (DE ANDRÉS *et al.* 2012, IBÁÑEZ *et al.* 2009, VARGAS *et al.* 2009) and European databases, genetic profiles given by LACOMBE *et al.* (2013) and *Vitis* International Variety Catalogue (/IVC, www.vivc.de). Genotype comparisons were carried out using Microsatellite toolkit v. 9.0 software package (PARK 2001). Since direct comparison of profiles was impossible without an additional harmonization procedure, we used the reference cultivars genotypes for adjusting the allele sizes and comparing genetic profiles between different databases.

Genetic diversity analyses: For the calculation of number of alleles (Na), expected heterozygosity (He), observed heterozygosity (Ho), frequency of null alleles (r) and probability of identity (PI), the software GENALEX 6 (PEAKALL and SMOUSE 2006) was used.

Results and Discussion

Microsatellite analyses: Three hundred and seventeen table grape accessions were genotyped at 20 different nuclear microsatellite loci resulting in 264 non redundant genotypes (Suppl. Tab. 1). Among them, 66 gen-

otypes (25 % of the non-redundant genotypes) obtained in this study at 20 microsatellite loci had not been published in the European microsatellite databases and constitute an important addition to genotype databases. These genotypes are highlighted in bold font in Suppl. Tab. 1.

Non redundant genotypes were used for the characterization of genetic diversity in the sample of table-grape cultivars (Suppl. Tab. 2). The analyzed loci revealed high levels of polymorphism. The total number of alleles per locus showed a variation between 5 (VVIQ52) and 18 (VMC4F3.1, VVMD28 and VVIV67), with an 11.65 average. This value is higher than the variation found in other table-grape cultivars collections such as the *Vitis* Germplasm Bank at the Finca El Encín (Madrid, Spain) (9.96) (IBÁÑEZ *et al.* 2009). Although the number of cultivars analyzed was lower than in the above-mentioned study. Among the 20 microsatellites, twelve were very informative, with a PI below 0.10 (VMC1b11, VMC4F3.1, VVMD5, VVMD7, VVMD25, VVMD27, VVMD28, VVMD32, VVIP31, VVS2, VVIV37, VVIV67) and the total probability of identity (PI) was 9.9×10^{-23} , which is a low value compared with other published data for those 20 microsatellites loci (LAUCOU *et al.* 2011) and for 25 microsatellite loci (IBÁÑEZ *et al.* 2009). The most informative locus was VMC4F3.1, for which 18 alleles were detected showing a PI value of 0.02. Finally, observed and expected heterozygosities were similar and very high, with only one marker (VVIN73) below 0.5.

Synonymies, homonymies and denomination mistakes: The genotypes obtained were compared with the genotype database of the Rancho de la Merced Germplasm Bank (JIMÉNEZ-CANTIZANO 2014), the *Vitis* Germplasm Bank at the Finca El Encín (IBÁÑEZ *et al.* 2009, VARGAS *et al.* 2009, DE ANDRÉS *et al.* 2012) and European databases (IVC and LACOMBE *et al.* 2013) to detect the presence of synonymies, homonymies and denomination mistakes. Many detected synonyms confirmed previous published descriptions and are already registered in the *Vitis* International Variety Catalogue (IVC). This is the case of synonymies found for 'Afus Ali' ['Actoni Macerón' (ESP074-3), 'Pepita de oro' (ESP074-317), 'Regina' (ESP074-364) and 'Rosaki' (ESP074-371)] or 'Ahmeur bou Ahmeur' ['Angelina' (ESP074-17), 'Flame Tokay' (ESP074-179)]. In addition, some of them could have considered typing errors such as: 'Dabouki'-'Dabcumi' (ESP074-122), or alternative spellings like 'Augusta Luise'-'Auguste Suisse' (ESP074-29), 'Dorona Veneziana'-'Dorona di Venecia' (ESP074-151), 'Malingre Precoce'-'Precoce di Malingre' (ESP074-345) and 'Michele Palieri'-'Micheli di Palieri' (ESP074-253, ESP074-254). 'Augusta Luise'-'Auguste Suisse' (ESP074-29) and 'Mavrud'-'Mawrub' (ESP074-250) are not typographical errors. 'Augusta Luise'-'Auguste Suisse' (ESP074-29) is considered an alternative spelling and 'Mavrud'-'Mawrub' (ESP074-250) is considered a synonym (check in Table). This type of synonym is very frequent in the IVC database (LACOMBE *et al.* 2011). In total, twenty-one possible new synonyms were detected (Table). 'San Jaime' (ESP074-390), 'Mondina' (ESP074-257), 'Muñeca' (ESP074-275) and 'Muscat Julius' (ESP074-279) could be considered new synonyms of known cultivars: 'Garnacha blanca', 'Mondeuse noire', 'Icod de los Vinos' and 'Mathiasz Janosne' respective-

ly. These three accessions are only maintained in the main Spanish collections (Rancho de la Merced [ESP074] and El Encín [ESP080]) according to the IVC. Other accessions identified as new synonymies (Table): 'Angelita' (ESP074-18), 'Del Barco' (ESP074-137), 'Fantasía' (ESP074-172), 'Sulina' (ESP074-406) and 'Tohauto' (ESP074-427), are only preserved in the Rancho de la Merced collection. All these accession names should be included in the list of synonyms in the IVC.

Other two new synonyms were detected for 'Ahmeur bou Ahmeur': 'Malagueña moscatel' (ESP074-241) and 'Parra de la Casa' (ESP074-311) (Table). 'Malagueña moscatel' (ESP074-241) has been reported as synonym for 'Teta de vaca blanca' (blanc) that is a 'Ahmeur bou Ahmeur' mutation only preserved at the *Vitis* Germplasm Bank of Finca El Encín (IMIDRA, Alcalá de Henares, Madrid) according to the IVC. At El Encín collection there are three homonyms 'Teta de Vaca' accessions with different genotypes according to IBÁÑEZ *et al.* (2009). In addition, IBÁÑEZ *et al.* (2003) analyzed four plants of 'Malagueña moscatel' at 13 microsatellite loci. They found that three of them were identical to 'Jaén colorado' (blanc) and one to 'Royal gordo' (noir) that is a synonym of 'Ahmeur bou Ahmeur' according to the IVC. The accession named 'Malagueña moscatel' analyzed in this work is noir (Table) and presented the same genotype as 'Ahmeur bou Ahmeur'. This result suggests that 'Malagueña moscatel' should be considered as a new synonym of 'Ahmeur bou Ahmeur'.

'Parra de la Casa' is a Spanish variety and 'Parra de don Gregorio' is considered synonym of this variety according to the IVC. Nevertheless, in the Rancho de la Merced collection these two accessions presented different genotypes. 'Parra de la Casa' (ESP074-311) showed identical genotype to 'Ahmeur bou Ahmeur' but different to 'Parra de don Gregorio' (ESP074-310). To reduce confusion, 'Parra de la casa' (ESP074-311) could be a synonym of 'Ahmeur bou Ahmeur' and 'Parra de don Gregorio' (ESP074-310) should be considered other different cultivar.

The results also revealed 14 homonymies and 48 misnomers in the Rancho de la Merced collection (Table). All homonym accessions presented a different genetic profile to that published in the analyzed databases.

Conclusion

Microsatellite analysis of 317 table-grape accessions identified 264 different genetics profiles. These results can help to group the varieties under a common and consensual identifying label. The results of this analysis will help in the rationalization and better management of germplasm preserved at this collection and can contribute to the identification of varieties included in the *Vitis* International Variety Catalogue (www.vivc.de).

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