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The "missing link" 'Blaue Zimmettraube' reveals that 'Blauer Portugieser' and 'Blaufränkisch' originated in Lower Styria

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Summary

Parent offspring analysis already revealed genetic relationships for 'Blauer Portugieser' and 'Blaufränkisch', sharing at each locus one allele with 'Grüner Silvaner' and 'Weisser Heunisch', respectively. The missing second progenitor of 'Blauer Portugieser' and 'Blaufränkisch' is a recently rediscovered black grapevine, called 'Blaue Zimmettraube'. It was found in the largest German wine growing area Rheinhessen. The same cultivar was detected as a single vine in Friuli, Italy and named Sbulzìna. The 'Blaue Zimmettraube', bearing female flowers, and thus the female parent in the crosses, was cultivated in the 19th century in Lower Styria together with 'Grüner Silvaner' and 'Weisser Heunisch'. Because the 'Blaue Zimmettraube' did not exist in Austria and red wine production was fairly rare in that country before 1800, it is suspected that the cradle of 'Blauer Portugieser' and 'Blaufränkisch' is in Lower Styria. Furthermore, according to chlorotype analysis, it turned out that 'Blauer Gänsfüsser' is the male parent of 'Blaue Zimmettraube' and thus the 'Blaue Zimmettraube' represents a veritable "missing link". To prove the genetic relationships the nine GrapeGen06-markers and additional forty microsatellite markers were applied. Likelihood analysis with allele frequencies of 22 SSR-markers from 772 cultivars revealed a very high degree of probability that the proposed parents are consistent, due to rare alleles inherited from 'Blaue Zimmettraube'. To investigate on the geographical origin of 'Blauer Portugieser' and 'Blaufränkisch' historical Austrian and Styrian references were consulted.

Introduction

Parent offspring analysis already revealed genetic relationships for 'Blauer Portugieser' and 'Blaufränkisch', sharing at each locus one allele with 'Grüner Silvaner' (Lacombe *et al.* 2013) and 'Weisser Heunisch' (Boursiquot *et al.* 2004), respectively. In this study the missing second parent of the two historically important red wine varieties 'Blauer Portugieser' and 'Blaufränkisch' is presented. Its discovery unravels the very probable cradle of the two cultivars.

Various hypotheses exist about the geographic origin of 'Blauer Portugieser' and 'Blaufränkisch'. According to a legend 'Blauer Portugieser' was introduced by the councilor of commerce and court councilor, Johann Baron von Fries, from Oporto in Portugal to Austria. Widely spread was the information that in 1772 Baron von Fries passed the cuttings from the delicious and newly arrived red cultivar to the people of Bad Vöslau in Austria finally to add a new and promising cultivar to the assortment (Langwieser 1953, Schumann 1981, Hachenberger 1996). With respect to 'Blaufränkisch', today most of the authors assume its birthplace in Lower-Austria or Croatia (Viala and Vermorel 1905-1910, Hachenberger 2000). However at the beginning of the 19th century Burger (1837) suspected a French origin. Besides the synonym "Fränkische" (Frankish) he cited a vineyard in Aichberger Ried at Gumpoldskirchen dating back to Duke Karl from Lorraine (1712-1780), where the larger upper part was entirely planted with 'Blaufränkisch'.

Recently, cultivars of international renown turned out to be the progeny of neglected and nearly extinct varieties, sampled during prospections or kept in grapevine repositories. Often they represented the "missing link" for incomplete parentages. For example 'Merlot Noir' resulted from a cross of 'Magdeleine Noire des Charentes' and 'Cabernet franc' (Boursiquot *et al.* 2009). A single vine of a no name trellis, later called 'Magdalene Noire des Charentes', was found in Brittany in 1996. Some years later further four plants were discovered in Charente in front of houses. The cultivar name given by the authors was a combination of an oral tradition, a historical citation and the geographical region. The significant Spanish red wine cultivar from Rioja, 'Tempranillo', descended from a liaison between 'Albillo Mayor' and 'Benedicto' (Ibañez *et al.* 2012). 'Benedicto' was held under three distinct names in Spanish grapevine collections and it was not possible to clearly assign the cultivar to any historical reference.

A comprehensive search for old autochthonous grape varieties was conducted in Friuli Venezia Giulia between 2001 and 2008 (Crespan *et al.* 2011). In 2006 a single plant of a red vine variety was discovered in a 100 year old vineyard in the middle east of the region close to the Slovenian border (Sivilotti *et al.* 2013). This variety was called Sbulzìna. The genetic profile was unique. No bibliographical citation or reference was found (Crespan *et al.*

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2011). Nearly in parallel (2007-2009) prospections were carried out in old German vineyards by Jung (2008, 2014) in the scope of a project financed by the German Federal Ministry for Food and Agriculture. In the wine growing area Rheinhessen Jung found a no name genotype and identified it as 'Blaue Zimmettraube' according to descriptions and drawings (Fig. 1) in Austrian ampelographies (Trummer 1841, Kreuzer and Kreuzer 2001). Jung modified the berry color prefix and named the cultivar 'Schwarze Zimmettraube'. In the 19th century this cultivar was fairly abundant in Lower Styria (today Slovenian Styria) particularly in the wine growing area around Gonobitz (today Slovenske Konjice) (Rath 1824, Bronner 1841), because the black berry skin was rich of coloring matter (Trummer 1841). Surprisingly, the Friulian 'Sbulzìna' and the 'Blaue Zimmettraube' from Rheinhessen displayed the same genetic profile and ampelographic features (Fig. 2) matched as well (Sivilotti *et al.* 2013). This female cultivar turned out to be the key for proposing the full parentage of 'Blauer Portugieser' and 'Blaufränkisch', bringing the discussion to an end about the geographic origin of the two cultivars.

Material and Methods

For the search of the missing parents of 'Blauer Portugieser' and 'Blaufränkisch' an excel macro and the SSR-marker database consisting of the nine GrapeGen06-markers VVS2, VVMD5, VVMD7, VVMD25, VVMD27, VVMD28, VVMD32, VrZAG62 and VrZAG79

Fig. 1: Bunch and leaves of the 'Blaue Zimmettraube' (Kreuzer and Kreuzer 2001).

Fig. 2: 'Blaue Zimmettraube' in the collection of the Institute for Grapevine Breeding Geilweilerhof (photo: E. Maul).

were used for prescreening. The SSR-marker database, established by the Julius Kühn-Institut (JKI), maintains about 15,000 genetic profiles of mainly *Vitis vinifera* L. subsp. *vinifera* cultivars/accessions (Maul and Töpfer 2015a). Additional 40 SSR-markers distributed equally across the 19 chromosomes were applied to validate the full parentage. Primer pairs were taken from Laucou *et al.* (2011), Sefc *et al.* (1999), Merdingoglu *et al.* (2005), Di Gaspero *et al.* (2006), Fechter *et al*. (2012) and some unpublished markers from the *Vitis* Microsatellite Consortium. Likelihood ratios were determined using IDENTITY4 software (ver. 4.0; Centre for Applied Genetics, University of Agricultural Sciences, Vienna). Allele frequencies were calculated using 22 SSR-markers: VrZAG62 and VrZAG79 from Laucou *et al.* (2011). They were obtained from 772 cultivars maintained at the Institute for Grapevine Breeding Geilweilerhof and covering a broad range of diversity. DNA extraction and PCR amplification was done according to Maul *et al.* (2015b). Sizes of fluorescently labeled DNA-fragments were determined with GeneMapper™ v.4.0 software (Applied Biosystems, Weiterstadt) based on a fluorescently labeled size marker covering the range of 75 to 500 bp.

Seven cultivars were genotyped with the 40 additional markers: 'Blauer Portugieser', 'Blaufränkisch', 'Grüner Silvaner', 'Weisser Heunisch', 'Blaue Zimmettraube', 'Graue Rauchfarbige Zimmettraube' and 'Blauer Gänsfüsser' (Tab. 1). 'Graue Rauchfarbige Zimmettraube' and 'Blauer Gänsfüsser' were added, because prescreening indicated a genetic relationship with 'Blaue Zimmettraube'. The seven cultivars are maintained in the grapevine collection of the Institute for Grapevine Breeding Geilweilerhof. 'Blaue Zimmettraube' was introduced into the collection in 2009. To investigate the geographical origin of 'Blauer Portugieser' and 'Blaufränkisch', historical Austrian and Styrian references were consulted. Synonyms applied by the authors are given (Tab. 1). Cultivars described by Helbling in 1777 were taken from Burger (1837).

Results and Discussion

'Grüner Silvaner', which is itself a cross of 'Traminer' and 'Weisser Österreicher' (Regner *et al.* 1998), was con-

Table 1

Listing of historical Austrian and Styrian references used in the present study. Cultivar names are given under which progenitors and offspring are cited and described

	Cultivar name	Blaue Zimmettraube	Blauer Portugieser	Blaufränkisch	Grüner Silvaner	Weisser Heunisch	Blauer Gänsfüsser	Graue Rauchfarbige Zimmettraube	Blauschwarze Zimmettraube
	Varitey number *V*IVC	24493	9620	1459	11805	5374	586	13449	17807
Author	Region								
Helbling 1777 Burger 1837)	Austria			Schwarzfränkische	Grüner Zierfandler	Weiße Grobe			
Rath (1824)	Styria	Zimmettraube, Kleine Wälsche Traube (p. 56)			Grüne Honigtraube (p. 47)	Malvasier, Gemeine Weiße Traube (p. 38)	Gänsefüßler (p. 61)		
Vest (1826)	Styria	*Catonia corvina*, Mittlere Zhernina (p. 46)			Ximenesia, Simonstraube (p. 56)	Edle Isidortraube (p. 55)	Gänsefüßler (p. 81)		
Heintl (1835)	Austria				Zirfahndler (p. 5)	Weiße Grobe (p. 5)			
Schams (1835)	Austria		Portugiesische (p. 59f)	Schwarzfränkische, Mährische (p. 59)	Zierfahnler (p. 60); Grüner und Rother Zierfahnler (p. 115f)	Baden: Grobe (p. 60); Pfaffenstetten: Grobe (p. 64); Grobe-Grobweisse (p. 112ff)			
Burger (1837)	Austria		Frühreife Garidelitraube (p. 60)	Mährische Traube, *Catonia burgundica* (p. 53)	Frühe Ximenestraube (p. 85)	Isidora nobilis, Edle Isidortraube (p. 82)	Spitzblättrige Garidelitraube (p. 64)		
Bronner (1841)	Styria	Blaue Zimmettraube (p. 16 und p. 17)			Sylvaner (p. 17)	Bellina (p. 16)			
Trummer (1841)	Styria	Blaue Zimmettraube (p. 143)	Früher Blauer Portugieser (p. 166)		Grüner Sylvaner (p. 174)	Weißer Heunisch (p. 52)	Gänsfußer (p. 26)	Rauchfarbige Zimmettraube (p. 146)	Mutation observed in 1839 on Graue Rauchfarbige Zimmettraube (footnote p. 146)
Trummer (1855)	Styria			Schwarze Fränkische (p. 17)					

sidered as progenitor of 'Blauer Portugieser' sharing half of its alleles at each locus (Lacombe *et al.* 2013). Likewise 'Weisser Heunisch' was already determined being a parent of 'Blaufränkisch' (Boursiquot *et al*. 2004). To find the missing progenitor for declaring the full parentage of 'Blauer Portugieser' and 'Blaufränkisch' the JKI SSR-marker database was used for a preliminary selection of candidates.

Only the 'Blaue Zimmettraube' was proposed, contributing the alleles not inherited by 'Weisser Heunisch' and 'Grüner Silvaner' respectively. The analysis of further 40 SSR-markers revealed that the rediscovered cultivar provided exactly the missing and rare alleles as well (Tab. 2). That is to say based on the allele frequencies of 22 SSR-markers from 772 cultivars 'Blaue Zimmettraube' passed rare alleles at four loci to 'Blauer Portugieser', namely VVS2: 255 (2 %), VVIP31: 171 (3 %), VVMD28: 260 (4 %) and VVIP60: 324 (6 %) and at three loci to 'Blaufränkisch', namely VVIP31: 171 (3 %), VVMD28: 246 (7 %) and VVIB01: 299 (9 %). In addition the two descendants inherited the rare wild female allele ATP3: 366 from 'Blaue Zimmettraube', which is present in only 4,2 % of 193 *Vitis vinifera* accessions analyzed by Fechter *et al.* (2012). Furthermore the allele frequencies served to calculate likelihood ratios via IDENTITY4 software to support the detected parentages. A very high ratio of probability that the proposed parents are matching versus the probability that two random individuals were the parents was obtained for 'Blauer Portugieser' with $5{,}31 \times 10^{20}$. For 'Blaufränkisch' the probability that the discovered parentage is consistent is $6{,}96 \times 10^{17}$ times higher than if two random cultivars created that offspring. Hence, 'Blauer Portugieser' turned out to be the progeny of the female 'Blaue Zimmettraube' and 'Grüner Silvaner' and 'Blaufränkisch' of 'Blaue Zimmettraube' and 'Weisser Heunisch', respectively. In addition, a parent offspring relationship of 'Blaue Zimmettraube' and 'Blauer Gänsfüsser' was found and validated by the 40 additional markers as well.

No genetic relationship existed between the homonymous 'Blaue' and 'Graue Rauchfarbige Zimmettraube' (Tab. 2c), even though the two cultivars are female and show the same geographical distribution limited to Styria. By the way a clone of 'Graue Rauchfarbige Zimmettraube' with blue berries was detected via fingerprint comparison in the European *Vitis* Database (www.eu-vitis.de) (Bacilieri and This 2010). It is maintained by the University of Zagreb, Faculty of Agriculture in Croatia under the name "Volovčec crni" (Preiner pers. comm.).

Genetic background of 'Blaufränkisch': The initial reason for the present study was that the JKI, Institut für Rebenzüchtung Geilweilerhof, uses a 'Regent' x 'Blaufränkisch' population to localise resistance loci against downy (*Plasmopara viticola*) and powdery mildew (*Erysiphe necator*), to establish a genetic map (Welter *et al.* 2007) and to elucidate defense mechanisms. In that context it was of interest to find and to know the genetic background of 'Blaufränkisch's second parent. It turned out that 'Blaue Zimmettraube' played a pivotal role, being the parent of 'Blaufränkisch' and the offspring of 'Blauer Gänsfüsser'. The latter was confirmed *via* the information given by Laucou (pers. comm.) that 'Blauer Gänsfüsser' belongs to chlorotype group D. 'Blaue Zimmettraube' displays chlorotype C. Being female all 'Blaue Zimmettraube' offspring would bear chlorotype C. 'Blauer Gänsfüsser' already turned out to be the progenitor of two Moldovan/Romanian, one Hungarian, one Italian and two French cultivars (Lacombe *et al.* 2013). The cultivar is fairly old. Already in 1505 its existence was reported for Deidesheim/Palatinate (Schumann 1997). The proof that 'Weisser Heunisch' (Maul *et al.* 2015b) and 'Blauer Gänsfüsser' are ancestors of 'Blaufränkisch' indicates a high portion of Eastern European genetic background in that cultivar. This finding is corroborated by Negrul and Nemeth, who established cultivar groups (proles), based on morphological features. According to Negrul 'Blaufränkisch' belongs to proles pontica, subproles georgica and Nemeth assigned the cultivar to proles orientalis, subproles caspica (Pospíšilová 1981).

Search for the geographical origin of 'Blauer Portugieser' and 'Blaufränkisch': Assuming that 'Blauer Portugieser' and 'Blaufränkisch' arose from a natural cross, documents were studied pointing to the area where the parents and the offspring coexisted. At least the two new crosses existed before 1750. In about 1755 the planting of a 'Blaufränkisch' vineyard at Gumpoldskirchen took place (Trummer 1855) and about 1770 Baron von Fries introduced 'Blauer Portugieser' in Vöslau (Burger 1837). Most ampelographical works written by Rath (1824), Vest (1826), Bronner (1841) and Trummer (1841) for Styria and Heintl (1835), Schams (1835) and Burger (1837) for Austria (Tab. 2) were published 70 to 100 years later. Nevertheless they were considered, assuming that the concerned varieties existed before as well. In Lower Styria Rath (1824), Vest (1826) and Bronner (1841) reported about the cultivation of the progenitors of 'Blauer Portugieser' and 'Blaufränkisch'. However the three authors did not cite the two descendants. In contrast, Trummer (1841) mentioned the existence of very old 'Blauer Portugieser' vines in Lower Styria in vineyards and gardens, which was confirmed by Dietl in 1850. In addition, the prominent ampelographer Trummer (1841) already stated analogue characteristics of 'Blauer Portugieser' and its parents. He wrote that the bunch of 'Blauer Portugieser' resembles 'Grüner Silvaner' and because of similar dark green and shiny leaves 'Blauer Portugieser' should not be confounded with 'Blaue Zimmettraube'. In Austria, however, both descendants were known and cultivated long before. An accurate description of 'Blaufränkisch' alias 'Schwarze Fränkische' was provided first by Helbling in 1777 (Burger 1837) who found it in the surroundings of Vienna. Sixty years later Schams (1835) recorded it interspersed in the 'Pinot noir' and 'Blauer Portugieser' vineyards around Bad Vöslau up to Baden, situated south of Vienna. Apparently, a 'Blaue Zimmettraube' did not occur. Before 1800 the production of red wine was rather scarce in the surroundings of Bad Vöslau and the red wine was always costlier than the white wine (Schams 1835). Based on the observation that at that time red wine was rather insignificant and due to the absence of 'Blaue Zimmettraube', it is very probable that the cradle of 'Blauer Portugieser' and 'Blaufränkisch' is Lower Styria. The reason why the two descendants did not play an

Table 2a

Genetic profiles of 'Blaue Zimmettraube' and 'Grüner Silvaner' and their offspring 'Blauer Portugieser'

Cultivar name/ marker	Blaue Zimmettraube	Blauer Portugieser	Grüner Silvaner	Cultivar name / marker	Blaue Zimmettraube	Blauer Portugieser	Grüner Silvaner
VVS2:1	143	143	151	VMC1A12:1	119	119	119
VVS2:2	143	151	153	VMC1A12:2	149	149	149
VVMD7:1	239	243	243	UDV13:1	99	99	99
VVMD7:2	255	255	247	UDV13:2	103	103	103
VVMD27:1	182	182	190	VMC1E12 : 1	240	240	244
VVMD27:2	195	195	195	VMC1E12 : 2	244	254	254
VVMD5:1	228	228	228	VMC3A8:1	165	165	165
VVMD5:2	228	234	234	VMC3A8:2	165	165	165
VVMD25:1	249	249	241	VMC3C9:1	258	258	247
VVMD25:2	255	249	249	VMC3C9:2	261	258	258
VVMD28:1	246	228	228	VMC5G7:1	198	198	198
VVMD28:2	260	260	236	VMC5G7:2	216	216	216
VVMD32:1	252	252	272	VMC5G8:1	312	314	304
VVMD32:2	272	272	272	VMC5G8:2	322	322	314
VrZAG62:1	194	188	188	VMC5H11:1	199	183	183
VrZAG62:2	204	204	204	VMC5H11:2	201	199	199
VrZAG79:1	251	249	249	VMC7H3:1	132	132	132
VrZAG79:2	259	259	251	VMC7H3:2	132	134	134
VMC1B11:1	169	173	173	VMC8A7:1	151	157	157
VMC1B11:2	175	175	185	VMC8A7:2	168	168	159
VMC4F3.1:1	171	171	169	VMC8E8:1	116	116	122
VMC4F3.1:2	203	171	171	VMC8E8:2	126	122	126
VrZAG83:1	188	190	188	VMC8F10:1	197	199	208
VrZAG83:2	194	194	190	VMC8F10:2	199	208	234
VVMD21:1	250	250	250	VMC8G6:1	135	135	155
VVMD21:2	257	259	259	VMC8G6:2	167	155	155
VVMD24:1	206	206	206	VrZAG21:1	199	199	199
VVMD24:2	206	214	214	VrZAG21:2	205	205	205
VVIB01:1	295	295	289	VVIB23:1	305	287	287
VVIB01:2	299	299	295	VVIB23:2	313	313	293
VVIH54:1	165	167	163	VVIM01:1	181	181	181
VVIH54:2	167	177	177	VVIM01:2	181	181	181
VVIN16:1	149	149	149	VVIM10:1	366	354	354
VVIN16:2	151	151	149	VVIM10:2	366	366	354
VVIN73:1	266	258	258	VVIN33:1	278	282	282
VVIN73:2	268	268	266	VVIN33:2	284	284	284
VVIP31:1	171	171	173	VVIN62:1	362	356	356
VVIP31:2	173	191	191	VVIN62:2	362	362	356
VVIP60:1	318	306	306	VVIN78:1	160	158	158
VVIP60:2	324	324	322	VVIN78:2	160	160	160
VVIQ52:1	76	76	82	VVIN85:1	354	354	354
VVIQ52:2	76	82	82	VVIN85:2	354	364	364
VVIV37:1	150	150	160	VVIP02:1	273	269	269
VVIV37:2	150	160	160	VVIP02:2	275	275	268
VVIV67:1	358	362	365	VVIP33:1	394	400	400
VVIV67:2	362	373	373	VVIP33:2	400	402	402
VrZAG67:1	127	121	121	VVIQ66:1	180	180	178
VrZAG67:2	145	127	155	VVIQ66:2	180	180	180
				ATP3:1	336	336	466
				ATP3:2	268	466	268

Table 2b

Genetic profiles of 'Blaue Zimmettraube' and 'Weisser Heunisch' and their offspring 'Blaufränkisch'

Cultivar name/ marker	Blaue Zimmettraube	Blaufränkisch	Weisser Heunisch	Cultivar name / marker	Blaue Zimmettraube	Blaufränkisch	Weisser Heunisch
VVS2:1	143	143	133	VMC1A12:1	119	119	119
VVS2:2	143	143	143	VMC1A12:2	149	119	119
VVMD7:1	239	239	239	UDV13:1	99	99	99
VVMD7:2	255	249	249	UDV13:2	103	99	103
VVMD27:1	182	180	180	VMC1E12 : 1	240	244	234
VVMD27:2	195	195	182	VMC1E12 : 2	244	244	244
VVMD5:1	228	228	236	VMC3A8:1	165	159	159
VVMD5:2	228	242	242	VMC3A8:2	165	165	165
VVMD25:1	249	249	239	VMC3C9:1	258	251	247
VVMD25:2	255	255	255	VMC3C9:2	261	261	251
VVMD28:1	246	246	228	VMC5G7:1	198	198	198
VVMD28:2	260	246	246	VMC5G7:2	216	216	198
VVMD32:1	252	250	250	VMC5G8:1	312	312	304
VVMD32:2	272	272	272	VMC5G8:2	322	312	312
VrZAG62:1	194	194	196	VMC5H11:1	199	189	189
VrZAG62:2	204	204	204	VMC5H11:2	201	199	203
VrZAG79:1	251	237	237	VMC7H3:1	132	132	132
VrZAG79:2	259	251	243	VMC7H3:2	132	132	132
VMC1B11:1	169	169	171	VMC8A7:1	151	151	151
VMC1B11:2	175	185	185	VMC8A7:2	168	151	159
VMC4F3.1:1	171	171	171	VMC8E8:1	116	116	116
VMC4F3.1:2	203	203	171	VMC8E8:2	126	126	126
VrZAG83:1	188	188	188	VMC8F10:1	197	197	199
VrZAG83:2	194	194	194	VMC8F10:2	199	199	208
VVMD21:1	250	250	250	VMC8G6:1	135	155	147
VVMD21:2	257	257	250	VMC8G6:2	167	167	155
VVMD24:1	206	206	206	VrZAG21:1	199	201	201
VVMD24:2	206	206	206	VrZAG21:2	205	205	205
VVIB01:1	295	299	295	VVIB23:1	305	287	287
VVIB01:2	299	299	299	VVIB23:2	313	313	305
VVIH54:1	165	165	149	VVIM01:1	181	181	181
VVIH54:2	167	167	167	VVIM01:2	181	181	181
VVIN16:1	149	149	149	VVIM10:1	366	366	354
VVIN16:2	151	149	149	VVIM10:2	366	366	366
VVIN73:1	266	266	266	VVIN33:1	278	284	280
VVIN73:2	268	268	266	VVIN33:2	284	290	290
VVIP31:1	171	171	173	VVIN62:1	362	356	356
VVIP31:2	173	173	181	VVIN62:2	362	362	362
VVIP60:1	318	322	322	VVIN78:1	160	160	160
VVIP60:2	324	324	324	VVIN78:2	160	160	160
VVIQ52:1	76	76	76	VVIN85:1	354	354	354
VVIQ52:2	76	82	82	VVIN85:2	354	354	354
VVIV37:1	150	150	160	VVIP02:1	273	273	269
VVIV37:2	150	160	168	VVIP02:2	275	275	273
VVIV67:1	358	358	365	VVIP33:1	394	394	394
VVIV67:2	362	366	366	VVIP33:2	400	394	400
VrZAG67:1	127	135	135	VVIQ66:1	180	178	178
VrZAG67:2	145	145	135	VVIQ66:2	180	180	180
				ATP3:1	336	336	466
				ATP3:2	268	466	268

Table 2c

Genetic profiles of 'Blauer Gänsfüsser', its offspring 'Blaue Zimmettraube' and the not directly related 'Graue Rauchfarbige Zimmettraube'

Cultivar name/ marker	Blauer Gänsfüsser	Blaue Zimmettraube	Graue Rauchfarbige Zimmettraube	Cultivar name/ marker	Blauer Gänsfüsser	Blaue Zimmettraube	Graue Rauchfarbige Zimmettraube
VVS2:1	133	143	133	VMC1A12:1	121	119	
VVS2:2	143	143	143	VMC1A12:2	149	149	
VVMD7:1	253	239	239	UDV13:1	99	99	
VVMD7:2	255	255	255	UDV13:2	103	103	
VVMD27:1	180	182	184	VMC1E12 : 1	244	240	
VVMD27:2	195	195	195	VMC1E12 : 2	244	244	
VVMD5:1	228	228	228	VMC3A8:1	159	165	
VVMD5:2	230	228	228	VMC3A8:2	165	165	
VVMD25:1	255	249	255	VMC3C9:1	251	258	
VVMD25:2	255	255	255	VMC3C9:2	261	261	
VVMD28:1	248	246	228	VMC5G7:1	192	198	
VVMD28:2	260	260	260	VMC5G7:2	216	216	
VVMD32:1	252	252	264	VMC5G8:1	304	312	
VVMD32:2	264	272	272	VMC5G8:2	322	322	
VrZAG62:1	192	194	188	VMC5H11:1	199	199	
VrZAG62:2	204	204	204	VMC5H11:2	199	201	
VrZAG79:1	251	251	249	VMC7H3:1	132	132	
VrZAG79:2	255	259	251	VMC7H3:2	134	132	
VMC1B11:1	169	169	183	VMC8A7:1	151	151	
VMC1B11:2	185	175	185	VMC8A7:2	161	168	
VMC4F3.1:1	181	171	185	VMC8E8:1	116	116	
VMC4F3.1:2	203	203	203	VMC8E8:2	116	126	
VrZAG83:1	188	188	188	VMC8F10:1	197	197	
VrZAG83:2	194	194	188	VMC8F10:2	199	199	
VVMD21:1	250	250	250	VMC8G6:1	155	135	
VVMD21:2	250	257	257	VMC8G6:2	167	167	
VVMD24:1	206	206	206	VrZAG21:1	199	199	
VVMD24:2	206	206	210	VrZAG21:2	199	205	
VVIB01:1	291	295	291	VVIB23:1	287	305	
VVIB01:2	295	299	291	VVIB23:2	305	313	
VVIH54:1	167	165		VVIM01:1	181	181	
VVIH54:2	167	167		VVIM01:2	181	181	
VVIN16:1	149	149	149	VVIM10:1	366	366	
VVIN16:2	149	151	149	VVIM10:2	366	366	
VVIN73:1	264	266	260	VVIN33:1	284	278	
VVIN73:2	268	268	264	VVIN33:2	288	284	
VVIP31:1	171	171	171	VVIN62:1	356	362	
VVIP31:2	193	173	185	VVIN62:2	362	362	
VVIP60:1	324	318	326	VVIN78:1	158	160	
VVIP60:2	332	324	328	VVIN78:2	160	160	
VVIQ52:1	76	76	76	VVIN85:1	354	354	
VVIQ52:2	76	76	76	VVIN85:2	354	354	
VVIV37:1	150	150	160	VVIP02:1	273	273	
VVIV37:2	160	150	168	VVIP02:2	275	275	
VVIV67:1	362	358	366	VVIP33:1	394	394	
VVIV67:2	366	362	366	VVIP33:2	402	400	
VrZAG67:1	135	127		VVIQ66:1	180	180	
VrZAG67:2	145	145		VVIQ66:2	180	180	
				ATP3:1	466	336	
				ATP3:2	268	268	

important role in Lower Styria may be due to the fact that in that area renowned red wine cultivars already existed like 'Kauka' and 'Blauer Kölner' (Bronner 1841, Trummer 1841).

Conclusion

In the past, unexpected pedigree reconstruction of renowned cultivars revealed the importance of lost and forgotten genotypes, because they represented the "missing link". This was again the case in the present study and underlines the necessity for continued prospection and for maintaining genotypes in collections even if they are not referenced and cannot be identified. Thus, the present investigation is a further proof for the utmost urgency to safeguard that rich resource.

An unknown plant was found in Germany and identified as 'Blaue Zimmettraube' from Lower Styria, even though geographically far away, thanks to high ampelographic competence. The indication of the name provided the corner stone for the present study, leaded to the correct identification of the cultivars country of origin and proves the imperative necessity to continue formation of ampelographers.

The knowledge about grapevine cultivars progenitors discloses the genetic composition and geographical origin of cultivars, assists to trace back migration routes and to estimate their distribution and importance in former times.

Wine growers are very interested in such information as grapevine cultivar related stories are beneficial for wine marketing.

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