附表 1 果实品质性状遗传群体连锁分析总结

Supplemental Table 1 Summary of genetic population linkage mapping analysis for berry quality traits

性状分类 Trait	亲本组合 Parents	群体（大小） Population (size)	连锁图谱分子标记（数目）Molecular makers type（number）	性状及定位连锁群（最高表型变异解释率）LG (PVE The maximum percent of variance explanation)	参考文献 Reference
果实大小 Berry size	MTP2223-27×MTP2121-30	F_1 (139)	AFLP (250), SSR (44), RAPD (2), SCAR (1)和 1 个颜色表型标记	BW18 (38%)	[4]
	Regent×Lemberger	F_1 (153)	RAPD、SSR 和 AFLP (母本图谱 265；父本图谱 164)	BW5, BW13-	[60]
	Italia×Big Perlon	F_1 (184)	AFLP (203)和 SSR (110)	BW4, 5 (19%), 13, 16, 20	[61]
	Dominga×Autumn Seedless	F_1 (118)	SSR 和 AFLP (189)	BW1, 9, 15, 18 (44%)	[40]
	Ruby Seedless×Sultanina	F_1 (144)	SSR、AFLP、ISSR (154)	BW18 (67%); BD 18 (58%);	[41]
	Italia×Big Perlon	F_1 (163)	SSR、AFLP、EST-derived 标记 (341)	BW1, 12, 18 (43%)	[42]
	Syrah×Grenache和 Grenache × Syrah	F_1 (191)	SSR (153)	BW1, 4, 7, 8, 12, 13, 17 (31%), 18	[5]
	MTP2223-27 × MTP2121-30	F_1 (139)	SSR (233)	BW1, 4, 11, 14, 17, 18 (61%)	
	MTP2687-85 × Muscat Hamburg	F_1 (174)	SSR (119)	BW5, 7, 11, 19 (25%)	
	D8909-15 × 90-116	F_1 (111)	SSR (255)	BW11 (8%)	[31]
	Ruby Seedless × Sultanina	F_1 (137)	SSR、AFLP、SNP SCAR (272)	BD2, 18 (37%); BW2, 18 (40%); BV2, 18 (45%)	[9]
	00C001V0008 × Ugni Blanc flb	F_1 (129)	SNP (父本图谱 714；母本图谱 408)	BW1, 7(44%), 8, 10	[23]
	87-1 × 9-22	F_1 (149)	SRAP 和 SSR (251)	BW5 (13%), 6	[20]
	626-84 × Iku82	F_1 (98)	SSR 和 MYB 单倍型 (213)	BW11 (40%)	[10]
	GF.GA-47-42 (Bacchus × Seyval) × Villard blanc	F_1 (151)	SSR 和 SNP (546)	BW10 (17%); BV12, 17 (20%)	[62]
	Raboso Veronese × Sultanina	F_1 (152)	SSR (161)	BW18(63.5%)	[59]
	Ruiduxiangyu × Moldova	F_1 (160)	SLAF (3411)	BW5, 11 (24.3%), 17; BL5 (23.5%), 8, 15, 17	[6]
	C81-227 × Y315-43-04	F_1 (215)	rhAmpSeq markers (849)	BW7, 9, 18 (28.1%); BL18 (14.3%); BD9, 18 (20.9%)	[7]
	Riesling × Cabernet Sauvignon	F_1（138）	Bin markers (母本图谱：889；父本图谱：982)	BA6, 17；BL6, 17；BD6, 17	[63]

果形 Berry shape	Ruiduxiangyu × Moldova	F_1 (160)	SLAF (3144)	ShI8 (25.0%)	[8]
	Xinya × E42-6	F_2 (208)	Bin markers (4401)	ShI4, 5 (19.8%)	[66]
	C81-227 × Y315-43-04	F_1 (215)	rhAmpSeq markers (849)	ShI8, 9, 18 (23.6%)	[7]
	BF × Y73 F1	F_1 (187)	Bin markers (3306)	ShI4, 8, 17	[67]
果肉质地 Berry texure	Ruby Seedless × Moscatuel	F_1 (78)	SSR 和 SNP (248)	BF5, 13 (17%)	[16]
	Muscat Hamburg × Sugraone	F_1 (153)	SSR (134)	BF1, 4, 9, 10, 18 (20%)	
	626-84 × Iku82	F_1 (98)	SSR 和 MYB 单倍型 (213)	BF3, 10 (31%)	[10]
	Ruby Seedless × Sultanina	F_1 (137)	SSR、AFLP、SNP SCAR (272)	BF8 (20%), 18	[68]
	Muscat Hamburg × Crimson Seedless	F_1 (105)	Bin 标记 (1662)	BF18(28.6%)	[17]
	Ruiduxiangyu × Moldova	F_1 (160)	SLAF (3144)	BF8 (20.1%)	[8]
	Raboso Veronese × Sultanina	F_1 (152)	SSR (161)	BH17, 18 (54.2%); BG17, 18 (53.2%); Bch18 (53.3%); Bco17, 18 (61.9%); BR17, 18 (62.5%)	[59]
	RedGlobe × Muscat Hamburg	F_1 (151)	Bin 标记 (2725)	MesF1, 4, 6, 8, 10 (20.7%), 11, 14, 17; PPH6, 10, 11 (25.8%), 14, 16, 17; PerB3, 6, 9 (17.4%), 14, 16	[15]
	C81-227 × Y315-43-04	F_1 (215)	rhAmpSeq markers (849)	BG12 (15.5%), 18；Bco13 (15.6%), 15, 17, 18; 多汁性 juciness19	[69]
糖酸含量 Sugar and acid content	D8909-15 × Vv 90-116	F_1 (111)	SSR (255)	SS3 (9.45%); pH1, 6 (10.34%), 11, 13, 16; TA6, 13, 19	[31]
	Beihong × E.S.7-11-49	F_1 (249)	SNP (1254)	Fru4, 11 (10%), 14, 17; Glu14 (8%); SS1, 14 (11%), 18; Glu/Fru2, 3, 7 (11%), 9, 17; Ma6 (17%), 18; TA6 (17%), 13, 18; Tar/Ma18 (16%)	[19]
	Vv00C001V0008 × Ugni Blanc flb	F_1 (129)	SNP (父本图谱 714；母本图谱 408)	酸含量acids2, 4, 5, 6, 7, 8, 9, 12, 13 (70%), 14, 17, 19; 糖含量sugars2, 7, 8, 16 (18%), 17, 19	[23]
	87-1× 9-22	F_1 (149)	SRAP 和 SSR (251)	SS3 (55.8%)	[20]
	626-84 × Iku82	F_1 (98)	SSR 和 MYB 单倍型 (213)	SS2 (24%); TA13 (29%)	[10]
	PI588259 × Seyval	F_2 (424)	SNP (1449)	SS1, 6 (19%), Ma1, 6 (26%),	[70]
	Vvmonastrell × Syrah	F_1 (229)	SSR 和 SNP (238)	TA1, 2 (18%); SS/TA1, 2 (20%), 4; Tar18, 19 (16%); Ma4, 5, 8, 9, 15 (29%), 17, 18; Tar/Ma5, 8 (21%), 11	[24]
	Riesling × Gewurztraminer	F_1（120）	SSR (双亲图谱 156); SNP (母本图谱 953); SNP (父本图谱 806)	Mal/Tar1, 6 (31.6%), 8, 10; Tar2, 6, 8 (30.6%), 13; Mal+Tar5 (20.6%); K^+2 (20.1%); K^+/Tart13 (19.2%); pH10, 11, 13 (19.2%), 14, 17	[25]
	Norton × Cabernet	F_1 (223)	SSR (384) 和 SNP (2084)	TA1 (12.3%), 6, 7, 9, 17; pH4, 6 (20.2%), 8;	[27]

	Sauvignon			Ma8 (20.1%), 14, 18.	
	Ruby Seedless × Sultanina	F_1 (138)	SNP (1737)	TA5(24.3%); Fru/Glu5(26%); Tar8 (14.8%)	[21]
	Horizon × Illinois 547–1	F_1 (255)	rhAmpSeq (1944)	Ma1, 7 (21.8%), 10, 17	[26]
	V. rupestris B38 × Horizon	F_1 (118)	rhAmpSeq (1948)	Ma14, 15 (12.4%)	
	BH × ES	F_1 (--)	Bin (2590)	SS6, 13; TA 6, 17	[67]
颜色 Berry color	Syrah × Vv Grenache和 Grenache × Syrah	F_1 (191)	SSR (153)	AntM1, 2 (27%)	[75]
	Syrah × Grenache和 Grenache × Syrah	F_1 (191)	SSR (153)	Ant2 (62%)	[29]
	Syrah × Grenache和 Grenache × Syrah	F_1 (191)	SSR (153)	VvUFGT2 (35%), 16	[73]
	D8909-15 × Vv 90-116	F_1 (111)	SSR (255)	Ant2 (12%)	[31]
	626-84 × Iku82	F_1 (98)	SSR (285)	Ant2 (40%), 8, 14	[32]
	626-84 × Iku82	F_1 (98)	SSR (285)	Ant1 (89%), 2, 6, 7, 13, 14, 18	[33]
	Syrah × Pinot N	F_1 (170)	SSR 和 SNP (690)	Ant1, 2 (89%), 4, 6, 7, 8, 9, 10, 12, 17, 18, 19	[34]
	87-1 × 9-22	F_1 (149)	SSR 和 SRAP (251)	Ant1, 2, 3, 4, 7, 9, 10 (64%), 12, 13, 14, 16, 19	[76]
	Black Beauty × Nesbitt 和 Supreme × Nesbitt	F_1 (172)	SNP (2346)	果实颜色 Berry color4	[77]
	Red Globe × Muscat Hamburg	F_1 (95)	Bin markers (1554)	CA2, 4(62.5%); CG2 (57.7%); Ant2 (44.6%), 17; DC2 (63.6%), 4; MC2 (59.0%), 4, 6; AC2 (26.0%), 4, 6, 11, 17	[35]
	MN1264 × MN1246	F_1 (125)	SNP (1641)	R1, 2(89.08%); G1, 2 (88.99%); B6, 15 (16.21%); L∗2 (89.04%); a∗2 (52.14%), 10; b∗2(89.26%); H1, 2 (89.08%), 7, 10; S 1, 2 (89.08%); I2 (89.04%)	[74]
	Raboso Veronese × Sultanina	F_1 (152)	SSR (161)	果实颜色Berry color2 (75.6%)	[59]
	BF × Y73	F_1 (187)	Bin (3306)	果实颜色Berry color2	[67]
无核性状 Seedless	Dominga × Autumn Seedless	F_1 (118)	SSR 和 AFLP (189)	SW1, 10, 18 (63%); SN11 (67%)	[40]
	MTP2223-27 × MTP2121-30	F_1 (139)	AFLP (250), SSR (44), RAPD (2), SCAR (1)和表型标记 (颜色 1)	SN8, 18 (51%); SW18 (49%)	[4]
	Ruby Seedless × Sultanina	F_1 (144)	SSR, AFLP, ISSR (154)	SW18 (85%); SN4 (96%), 16, 18;	[41]
	Italia × Big Perlon	F_1 (163)	SSR、AFLP、EST-derived 标记（341）1426cM	SN2 (23%); SW2, 6, 10, 13, 15, 18 (75%)	[42]
	Ruby Seedless × Sultanina	F_1 (139)	SSR (27) 仅仅 18 号连锁群		[78]
	Syrah × Grenache和	F_1 (191)	SSR (153)	SN2 (48%), 4, 13; SW1, 2 (45%), 4, 13, 19	[5]

	Grenache × Syrah				
	MTP2223-27 × MTP2121-30	F_1 (139)	SSR (233)	SN5, 18 (59%); SW8, 12, 14, 18 (87%)	
	MTP2687-85 × Muscat Hamburg	F_1 (174)	SSR (119)	SN8, 14 (28%); SW8, 11, 14, 16 (41%)	
	Ruby Seedless × Sultanina	F_1(137)	SSR, AFLP, SNP, SCAR (272)	SW18 (70%)	[9]
	Vv00C001V0008 × Ugni Blanc flb	F_1(129)	F1 (129)	SN7 (76%)	[23]
	Red Globe × Crimson Seedless	F_1(292)	SSR 和 SNP (290)	SW2, 5, 14, 18 (83%)	[79]
	Muscat of Alexandria × Crimson Seedless	F_1(573)	Bin (母本图谱 1541; 父本图谱 1534)	SEDW9, 13 (母本图谱); 4, 14, 18 (48.4%) (父本图谱); SN1,2 (9.3%), 8, 13; 1, 2, 7, 12, 18 (父本图谱); SW2, 9, 13 (母本图谱); 2, 8, 10, 14, 18 (42.5%) (父本图谱)	[80]
	Red Globe × Centennial Seedless	F_1 (114)	SNP (--)	种子大小 seed size6, 7, 8, 11, 13, 17	[81]
玫瑰香味 Muscat flavor	Italia × Big Perlon	F_1(163)	SSR、AFLP、EST 标记 (341)	单萜 Monoterpene5 (84%), 10；	[46]
	Moscato Bianco × Vri Wr 63	F_1 (174)	SSR、AFLP 和 SSCP 标记 (母本图谱 338；父本图谱 429)	单萜 Monoterpene2, 5 (92%)	
	MTP2687-85 (Olivette Ribol) × Muscat Hamburg	F_1 (174)	SSR (139)	单萜 Monoterpene2, 5 (55%), 13, 16；	[44]
	Muscat Ottonel ×Muscat Ottonel	F_1 (121)	SSR (84)	单萜 Monoterpene1, 5 (87%), 10, 13, 15	[47]
	Ruiduxiangyu × Moldova	F_1 (160)	SLAF (3144)	玫瑰香味Muscat flavor5 (21.8%)	[8]
	Ruiduxiangyu × Moldova	F_1 (160)	SLAF (3144)	关键途径基因表达Key gene expression6, 12 16	[91]
	87-1 × 9-22	F_1 (149)	SSR (255)	单萜 Monoterpene5, 10, 11, 18 (42.5%)	[87]
	Campbell Early × Muscat of Alexandria	F_1 (95)	SSR (338)	单萜 Monoterpene2, 5 (40%), 7, 15; 降异戊二烯 Norisoprenoids2(40.3%)	[89]
	Deckrot x G1-7720	F_1 (82)	SNP 和 SSR (母本图谱 1910; 父本图谱 2252)	单萜 Monoterpene5 (50.9%), 12, 13, 17	[90]
	Beifeng × 3–34	F_1 (150)	SNP(3332)	单萜 Monoterpene3, 5, 8, 11, 12, 14, 16, 19(45%)	[88]
涩味 Astringency	Norton × Cabernet Sauvignon	F_1 (223)	SNP (2084)和 SSR (384)	单宁 tannins2 (24.7%)	[27]
	Syrah × Grenache	F_1 (191)	SSR (153)	果皮 PA 含量 2, 8 (16.1%), 13 和 17; 种子 PA 含量 1, 2 (18.5%), 3, 4, 8, 10, 12, 13, 14, 16, 17, 18; 果皮 epiEx3, 5, 6, 8, 10 (13.9%), 13, 17, 18; 果皮 galEx2, 3, 14 (14.7%); 果皮 egcEx 3, 6, 8, 10 (13.3%), 18; 果皮 catT 1, 6,	[92]

			8, 17 (55.8%); 果皮 epiT 8, 17 (18.3%) mDP 1, 6, 8, 17 (55.2%); 种子 catEx 1, 4, 5, 6, 8, 14, 15, 16, 17 (19.2%), 19; 种子 epiEx 5, 8, 17 (15.0%); 种子 galEx 1, 2, 4, 7, 12, 17 (15.1%), 18; 种子 catT 2 (18.1%), 4, 8, 14, 17, 18, 19; 种子 epiT 1, 4, 5, 8, 9, 11, 14, 17 (38.4%), 18, 19; 种子 galT 1, 7, 8, 10 (14.4%), 12, 14, 16, 17, 18; 种子 mDP 4, 14, 17 (38.6%)	
Muscat of Alexandria ×Campbell Early	F_1 (95)	SSR（338）	果皮 PA 含量 1 (21.5%); 果皮 EpG 1 (32.3%); 果皮 PA %G 1 (53.7%); 果皮 PA mDP17 (53.2%); 种子 PA %G 1 (36.7%) 18; 种子 PA mDP17 (30.7%)	[93]

AFLP：扩增片段长度多态性；SSR：简单重复序列；RAPD：随机扩增多态性DNA ；SCAR：序列特异性扩增区；SNP：单核苷酸多态性；SLAF：特异性位点扩增片段；rhAmpSeq：重组酶介导的聚合酶链式反应序列标记；Bin：bin标记；SSCP：单链构象多态性；LG：连锁群；BW：果实单重；BL：果实纵径；BD：果实横径；BA：果实面积；BV：果实体积；ShI：果形系数；BF：果实硬度；BH：果实硬度；BG：果实黏性；Bch：果实咀嚼性；Bco：果实凝聚性；BR：果实弹性；MesF：果肉硬度；PPH：果皮穿刺硬度；PerB：果皮脆性；SS：可溶性固形物含量；pH：酸碱度；TA：可滴定酸含量；Fru：果糖；Glu：葡萄糖；Glu/Fru：果糖/葡萄糖；Ma：苹果酸；Tar：酒石酸；Ant：花色苷；AntM：花色苷甲基化水平；VvUFGT：花色苷糖基转移酶；CA：色差；CG：颜色等级；DC：三羟基化花青素；MC：甲基化花青素；AC：酰基化花青素；R：红色；G：绿色；B：蓝色；L*：亮度；a*：红绿色值；b*：蓝黄色值；H：色调；S：饱和度；I：强度；SN：种子数量；SW：种子重量；SEDW：每个果实中种子重量；PA：原花色素；EpG：表儿茶素没食子酸酯；%G：表儿茶素没食子酸酯）占总量的摩尔百分比；mDP 原花色素亚组分与端基组分百分比，表示聚合物的大小；epiEx：表儿茶素延伸亚基；catEx：儿茶素延伸亚基；galEx：表儿茶素没食子酸酯延伸亚基；egcEx：表没食子儿茶素延伸亚基；catT：儿茶素末端亚基；epiT：表儿茶素末端亚基；galT：表儿茶素没食子酸酯末端亚基；mDP：平均聚合度。文献同文中

AFLP: Amplification fragment length polymorphisms; SSR: Simple sequence repeat; RAPD: DNA random amplified polymorphic DNA; SCAR: Sequence-characterized amplified region; SNP: Single nucleotide polymorphism; SLAF: Specific locus amplified fragment; rhAmpSeq: rhAmpSeq markers; Bin: Bin markers; SSCP: Single strand conformation polymorphism; LG: Linkage group; BW: Berry weight; BL: Berry length; BD: Berry diameter; BA: Berry area; BV: Berry volume; ShI: Shape index; BF: Berry firmness; BH: Berry hardness; BG: Berry gumminess; Bch: Berry chewiness; Bco: Berry cohesiveness; BR: Berry resilience; MesF: Mesocarp firmness; PPH: Pericarp puncture hardness; PerB: Pericarp brittleness; SS: Total soluble solid content; pH: pH value; TA: Titratable acidity; Fru: Frucose; Glu: Glucose; Glu/Fru: Frucose/Glucose; Ma: Malic acid; Tar: Tartaric acid; Ant: Anthocyanins; AntM: Methylation level of anthocyanins; VvUFGT: UDP-glucose flavonoid 7-O-glucosyltransferase; CA: Chromatic aberration; CG: Color grade; DC: Trihydroxylated anthocyanins; MC: Methylated anthocyanins; AC: Acylated anthocyanins; R: Red; G: Green; B: Blue; L*: Lightness; a*: Green-red; b*: Blue-yellow; H: Hue; S: Saturation; I: Intensity; SN: Seed number; SW: Seed weight; SEDW: Seed fresh weight per berry; PA: Proanthocyanidins; EpG: Epicatechin gallate; %G: The mol percent of galloylated subunits (epicatechin gallate) of the total subunit within Pas; mDP : The mol percent of total subunits (the sum of terminal and extension) to terminal subunits within PAs, indicating the polymer size; epiEx: (-)-epicatechin extension subunit; catEx: (+)-catechin extension subunit; galEx: (-)-epicatechin-3-O-gallate extension subunit; egcEx: (-)-epigallocatechin extension subunit; catT: (+)-catechin terminal subunit/monomer; epiT: (-)-epicatechin terminal subunit/monomer; galT: (-)-epicatechin-3-O-gallate Terminal subunit/monomer; mDP: Mean degree of polymerisation. In the same literature