

Table S1. Agronomic traits of parental grape cultivars used in this study.

Parent type	Hybrid code	Cultivar	Scientific name	Berry color	Berry weight	Core elite traits
Female	-	‘Shine Muscat’	<i>Vitis labrusca</i> × <i>V. vinifera</i> cv. Shine Muscat	Green	8-12 g	High fruit quality, muscat aroma, wide adaptability
Male 1	C1	‘Romantic Beauty’	<i>Vitis vinifera</i> × <i>V. labrusca</i> cv. Romantic Beauty	Red	10-13 g	High disease resistance, excellent appearance
Male 2	C2	‘Moldova’	<i>Vitis vinifera</i> × <i>V. amurensis</i> cv. Moldova	Purplish-black	5-8 g	High disease resistance, cold hardy
Male 3	C3	‘Shenzhou Red’	<i>Vitis vinifera</i> cv. Shenzhou Red	Red	8-12 g	High disease resistance, excellent fruit quality
Male 4	C4	‘Queen Nina’	<i>Vitis vinifera</i> cv. Queen Nina	Red	13-17 g	Extra large berry size, high disease resistance
Male 5	C5	‘Giant Rose’	<i>Vitis vinifera</i> × <i>V. labrusca</i> cv. Giant Rose	Purplish-black	9.5-12 g	High temperature tolerance, disease resistant
Male 6	C6	‘Hotan Red’	<i>Vitis vinifera</i> cv. Hotan Red	Red	6-10 g	Cold hardy, drought tolerant, salt-alkali tolerant
Male 7	C7	‘Sweet Sapphire’	<i>Vitis vinifera</i> cv. Sweet Sapphire	Purplish-black	10-14 g	Cold hardy, drought tolerant, unique fruit shape
Male 8	C8	‘Zuijinxian g’	<i>Vitis vinifera</i> × <i>V. labrusca</i> cv. Zuijinxian g	Green	10-15 g	Strong disease resistance, high sugar content
Male 9	C9	‘Gold Finger’	<i>Vitis vinifera</i> × <i>V. labrusca</i> cv. Gold Finger	Green	8-10 g	Cold hardy, disease resistant, wide adaptability