

晚熟桃新品种韦端蜜红的选育

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摘要: 韦端蜜红是从福建省古田县吉巷乡韦端村桃园中优选出的晚熟桃芽变新品种。具有晚熟、果大、肉脆、味甜、抗逆性较强等优良性状。果实近圆形, 果顶微凸, 果实缝合线浅且较明显, 平均单果质量 259 g; 果皮底色黄绿色, 果面带有深红色红晕; 果肉黄白色, 果汁多, 风味甜, 可食率达 93.73%, 成熟果实硬度为 10.91 kg·cm⁻²。果实汁液可溶性固形物含量(w, 后同)12.6%~14.5%, 总糖含量(以葡萄糖计)10.4%~11.0%, 可滴定酸含量(以苹果酸计)0.15%~0.21%, 抗坏血酸(维生素C)含量 10.2 mg·100 g⁻¹, 果皮花青素、总酚、类黄酮含量分别为 18.03 mg·kg⁻¹、1.65 mg·g⁻¹ 和 1.53 mg·g⁻¹。在古田县 3 月上旬始花, 果实成熟期为 7 月下旬至 8 月上旬, 果实生长发育期约为 135 d, 在株行距 5.02 m×5.03 m 条件下, 5 年生树株产达 92.41 kg。适宜在福建省桃主产区推广种植。

关键词: 晚熟桃; 新品种; 韦端蜜红

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A new late-mature peach cultivar Weiduanmihong

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Abstract: Peach [*Prunus persica* (L.) Batsch.] is one of the deciduous fruit crops in Rosaceae originated from China, which is popular in the world. China has the world's largest yield of peaches, accounting for approximately three-fifths of the world. Fujian province locates in a subtropical climate and on the west coast of the Taiwan Strait. Gutian county in Ningde city, situated in Fujian province's east coastal area, is about 100 kilometers away from Fuzhou. Late-mature peach denotes a fruit development period of 121–150 days. Weiduanmihong is a late-mature peach germplasm resource budded from Yihong. The mutant of late-mature tree was found in 1994, which showed late-maturity, high quality, high yield, large and sweet fruit, strong stress resistance, richness in phenolic substances and stable excellent characteristics. Comprehensive analyses of ISSR (inter-simple sequence repeat) molecular markers showed that Weiduanmihong and Yihong could be differentiated at the similarity coefficient of 0.92 with UPGMA (unweighted pair-group method with arithmetic means) cluster analysis. And Weiduanmihong had different polymorphic bands from the Yihong. There are differences at the DNA level between Weiduanmihong and Yihong, showing that the Weiduanmihong is a bud-sport from Yihong. It has passed the professional certification by Fujian Forestry Bureau and it is called Weiduanmihong (S-SV-PP-015-2021). Weiduanmihong has an open-center crown with light gray brown trunk. Leaf is long ovate-lanceolate with margin serrate. The flowers are rose-shaped with 5 petals. The optimum humidity at flowering stage is 67%–87%, and the most suitable temperature is 12–14 °C. The fruit is near round with the apex slightly convex, and the suture line is obvious. The average weight of single fruit is 259 g. The ground color of the fruit is green-yellow with dark red color near the stone. The flesh is yellow-

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white, hard and crispy and semi-cling stones. The edible rate of the juicy and sweet fruit is 93.73%, the flesh firmness is $10.91 \text{ kg} \cdot \text{cm}^{-2}$, and the total soluble solid content is 12.6%–14.5%. As a high-quality fruit, the total organic acid (as malic acid), sugar (as glucose) and ascorbic acid (vitamin C) contents are 0.15%–0.21%, 10.4%–11.0% and $10.2 \text{ mg} \cdot 100 \text{ g}^{-1}$, respectively. The peel of Weiduanmihong fruit contains higher amounts of phenolic compounds and other antioxidants than the flesh. The total phenol content in the peel and flesh are $1.65 \text{ mg} \cdot \text{g}^{-1}$ and $0.66 \text{ mg} \cdot \text{g}^{-1}$, respectively. The flavonoid content in the peel and flesh are $1.53 \text{ mg} \cdot \text{g}^{-1}$ and $0.47 \text{ mg} \cdot \text{g}^{-1}$, respectively. The total anthocyanin content in the peel and flesh are $18.03 \text{ mg} \cdot \text{kg}^{-1}$ and $0.41 \text{ mg} \cdot \text{kg}^{-1}$, respectively. The main anthocyanin in peel is cyanidin and pelargonidin, while main anthocyanin in flesh is cyanidin by HPLC (high performance liquid chromatography). The contents of cyanidin in peel and flesh are $75.89 \text{ mg} \cdot \text{kg}^{-1}$ and $0.87 \text{ mg} \cdot \text{kg}^{-1}$, and the content of pelargonidin in peel is $9.89 \text{ mg} \cdot \text{kg}^{-1}$. In Ningde, Fuzhou and Nanping city, Weiduanmihong peach starts bud break in late February, the early flowering period and full flowering stage are in early March, and the flowering ends in the mid-March. The peach fruit development period lasts for about 135 days, which is a typical late-mature peach variety. The fruit maturity stage ranges from late July to early August, which is 10–15 days later than that of Yihong. Defoliating period is in late November. The yield per 666.7 m^2 reaches up to 2 402.66 kg (26 peaches, 5 a plants). As a fresh fruit in off-season, Weiduanmihong peach fruit has a good economic value and is popular with consumers for its high nutrition. Planting hole is $1.0 \text{ m} \times 1.0 \text{ m} \times 0.8 \text{ m}$ and the distance between peach trees is 4–5 meters. Leaf-curl, brown rot, anthracnose, bacterial shot-hole, gummosis, white mould and brown rust are the common diseases of Weiduanmihong. The common insect pests include aphid, hawthorn spider mite, white mulberry scale, long-horned beetle, peach borer, oriental fruit moth, fruit fly, and fruit-piercing moth. At present, the cultivation area of Weiduanmihong peach is about 200 hm^2 , and the annual output of Weiduanmihong amounts up to 3000 tons. Weiduanmihong has strong resilience, and this cultivar is suitable for planting in peach planting area of Fujian province. It also should be paid attention to pest and disease control. Integrated agricultural technology including clearing the orchard in winter, enhancing the tree resistance by the application of organic fertilizer, etc. is encouraged to control the pests and diseases of Weiduanmihong.

Key words: Late-mature peach; New variety; Weiduanmihong

桃 [*Prunus persica* (L.) Batsch.] 为蔷薇科李属桃亚属落叶果树, 是世界上栽培最广泛的蔷薇科果树之一。2021年福建省桃总产量约 16.98 万 t, 种植面积约为 1.21 万 hm^2 ^[1]。晚熟桃是果实发育期为 121~150 d 的桃品种^[2], 能够弥补市场夏秋之交及深秋新鲜水果的空缺。1994年, 在福建省古田县吉巷乡韦端村定植的颐红桃果园中发现了一株芽变, 经过多年观察与统计, 该株系表现出了迟熟、果大、可溶性固形物含量较高、丰产等优良性状。通过对果实和其他重要的经济性状进行全面鉴定, 优选出晚熟桃优良新品种韦端蜜红。

1 选育过程

1994年, 笔者课题组在韦端村定植的颐红品种

桃园中发现一株芽变, 表现出迟熟、果大、可溶性固形物含量较高、高产、抗逆性较强等优良特性, 因此, 2000年在韦端村进行了嫁接鉴定(砧木为2年生毛桃), 嫁接树2002年开始结果。之后, 在福建省不同气候区建立多个区试点和核心示范种植基地, 系统地开展了生物学特征特性观察、区域生态适应性研究、果实分析鉴评及关键配套栽培技术应用试验等。目前在福建省内区试和推广面积约 200 hm^2 , 年产量 3000 t 左右, 促进了福建省桃品种结构的调整, 提高了桃栽培的经济效益。2021年12月31日通过了福建省林木品种审定委员会审定, 品种名称为韦端蜜红(品种编号: 闽 S-SV-PP-015-2021, 学名: *Prunus persica* L. Batsch. ‘Weiduanmihong’, 图1)。韦端蜜红嫁接三代的主要性状比较见表1。



图1 韦端蜜红桃果实及其成年树

Fig. 1 Peach fruit and adult trees of Weiduanmihong

表1 韦端蜜红无性繁殖的性状

Table 1 Characters of the asexual reproduction of Weiduanmihong

户主 Farmers	嫁接繁殖 Propagation by grafting	树龄 Tree age/a	开花期 Period of blooming	果实成熟期 Mature period	株产量 Yield per tree/kg	单果质量 Average mass of single fruit/g	可食率 Edible rate/%	w(可溶性 固形物) Total soluble solid content/%	落叶期 Defoliating period
韦日意 Wei Riyi	母树 Mother tree	16	02-25—03-15	7月下旬至8月上旬 Late Jul. to early Aug.	210.80	260	93.00	10.60	11月下旬 Late Nov.
吴孝钦 Wu Xiaoqin	嫁接一代 The first grafting	12	02-26—03-14	7月下旬至8月上旬 Late Jul. to early Aug.	106.00	190	94.15	11.53	11月下旬 Late Nov.
程忠南 Cheng Zhongnan	嫁接二代 The second grafting	8	02-23—03-20	7月下旬至8月上旬 Late Jul. to early Aug.	89.57	259	93.73	11.89	12月上旬 Early Dec.

2 主要性状

2.1 植物学特征

韦端蜜红树势中等,树姿开张,幼龄树枝梢较直立,结果后呈半开张型,树干浅灰褐色。叶为完全叶,叶缘具锯齿状,叶片长10.8~12.5 cm,叶片宽3.6~4.2 cm,叶柄长1.6~2.2 cm。花为上位子房、下位花的完全花,花芽分化在7—8月进行,属夏秋分化型。单花或复花,盛花当天花瓣浅红,基部近白色,花丝浅绿色,萼片外展;第2天花瓣基部微红;第3天花瓣微红面扩大,花丝微红;第4、5天花瓣、花丝全呈桃红色;花丝由散乱状聚拢直立,萼片也相随直

立,花瓣开始陆续脱落。开花持续约1周。气温达10℃即可开花,最适温度为12~14℃。花期最适湿度67%~87%,若遇高温干旱热风,3 d即可谢花,若遇阴雨连绵低温,花期则会推迟。花粉多,自花结实率高。

2.2 果实经济性状

韦端蜜红结果早、晚熟,果实的成熟期比颐红迟10~15 d。果实平均单果质量259 g,果实近圆形,果顶微凸,果肩宽广,果面绿黄,成熟时向阳面深红色。茸毛少,果肉黄白色,肉质细韧,味甜香浓,果肉近核处红色,品质上等。硬溶质,耐贮运,货架期长。成熟果实的硬度为10.91 kg·cm⁻²,可食率为

93.73%,可溶性固形物含量(w,后同)为12.6%~14.5%,总糖(以葡萄糖计)含量为10.4%~11.0%,可滴定酸(以苹果酸计)含量为0.15%~0.21%,维生素C含量为10.2 mg·100 g⁻¹。韦端蜜红果实富含抗氧化的功能物质,酚类物质含量丰富,成熟果实果皮和果肉总酚含量分别为1.65 mg·g⁻¹和0.66 mg·g⁻¹,类黄酮含量分别为1.53 mg·g⁻¹和0.47 mg·g⁻¹,总花青素含量分别为18.03 mg·kg⁻¹和0.41 mg·kg⁻¹。通过高效液相色谱(HPLC)^[3-4]分析花青素组分含量发现,果皮中含有矢车菊色素和天竺葵色素,果肉中含有矢车菊色素。韦端蜜红成熟果实的果皮和果肉的矢车菊色素含量分别为75.89 mg·kg⁻¹和0.87 mg·kg⁻¹,果皮中的天竺葵色素9.89 mg·kg⁻¹。

韦端蜜红连续三代无性繁殖的性状保持稳定,果大质优,外观艳丽,味甜多汁,酸甜适口,香味浓郁,营养丰富,经济性状稳定(表1)。

2.3 生长结果习性

韦端蜜红桃喜光,成枝力强,树势强健,树梢开

张,自花结实率高,丰产,耐贫瘠。结果枝有徒长结果枝、长果枝、中果枝、短果枝等类型,以长、中、短果枝结果为主。幼龄树以下垂的中、长结果枝为主,盛果期树以长、中、短果枝为主,老龄树则以徒长结果枝和长、中果枝为主。定植2~3 a始果,5~8 a即达盛果期,经济寿命15~20 a。5年生树单株产量92.41 kg,株行距5.02 m×5.03 m,每666.7 m²产量可达2 402.66 kg(每666.7 m²栽植26株)。

2.4 物候期

韦端蜜红桃在福建宁德、福州、南平等地花芽萌动期为2月下旬,花蕾期2月底,始花3月初,盛花3月上旬,终花3月中下旬。第1次生理落果期为4月上旬,第2次生理落果期为5月上旬。新梢抽生在3月中旬。4—5月新梢生长快速,6—7月新梢生长缓慢,8月枝梢停长,11月下旬至12月落叶。韦端蜜红与颐红的开花期和生理落果期相近,但韦端蜜红的果实成熟期比颐红迟10~15 d(表2)。

表2 2020年韦端蜜红与颐红物候期

Table 2 Comparison of phenophase between Weiduanmihong and Yihong in 2020

品种 Cultivar	开花期 Period of blooming				生理落果期 Physiological fruit-dropping period		果实成熟期 Mature period	落叶期 Defoliating period
	花蕾期 Bud stage	始花期 Early flowering period	盛花期 Peak flowering stage	终花期 Ending flowering period	第1次 First time	第2次 Second time		
韦端蜜红 Weiduanmihong	02-25	03-02	03-08	03-15	04-03	05-02	07-20—08-10	11月下旬 Late Nov.
颐红 Yihong	02-26	03-02	03-09	03-16	04-02	05-02	07-10—07-30	11月下旬 Late Nov.

2.5 适应性和抗逆性

经过多年观察,在宁德、福州、南平等地春寒的持续低温年份,韦端蜜红桃花期表现较强的抗寒性和适应性。韦端蜜红桃植株具有较强的抗逆性。

3 遗传鉴定

对来自湖南芷江的颐红、古田本地的颐红以及

韦端蜜红进行了遗传学鉴定,样品信息见表3。选取不同品种晚熟桃的嫩叶,使用CTAB法提取其DNA,建立ISSR-PCR反应体系^[5-7],筛选出多态性和重复性好的15条ISSR引物(表4),对3个晚熟桃样品进行PCR扩增和琼脂糖电泳检测,分析其遗传多样性。引物UBC840扩增结果中韦端蜜红与颐红扩增条带差异明显(图2);韦端蜜红与其亲本颐红间

表3 供试3份桃材料信息

Table 3 Material information of 3 peach samples

编号 Number	名称 Name	采集地 Collection place	树龄 Tree age/a
C1	芷江颐红 Zhijiang Yihong	湖南省芷江侗族自治县康瑞生态农业有限公司 Kangruinong Ecological Agriculture Co., Ltd Zhijiang, Hunan	8
C2	古田颐红 Gutian Yihong	福建省古田县福建省益康园农场有限公司 Fujian Yikangyuan Farm Co., Ltd, Gutian, Fujian	5
C3	韦端蜜红 Weiduanmihong	福建省古田县吉巷乡韦端村 Weiduan, Ningde, Fujian	8

表4 ISSR 引物序列及其产物多态性

Table 4 Polymorphism detected with ISSR primers in late-mature germplasm accessions

ISSR 引物编号 ISSR primer ID	引物序列(5'-3') Primer sequence (5'-3')	退火温度 Annealing temperature/°C	扩增条带数 Total number of bands	多态性条带数 Number of polymorphic bands	多态性带占比 Percentage polymorphism bands/%
UBC811	GAGAGAGAGAGAGAGAC	55	5	1	20.00
UBC812	GAGAGAGAGAGAGAGAA	52	8	0	0.00
UBC817	CACACACACACACAAA	53	5	0	0.00
UBC823	TCTCTCTCTCTCTCC	52	4	0	0.00
UBC826	ACACACACACACACC	52	5	1	20.00
UBC834	AGAGAGAGAGAGAGAGYT	52	4	0	0.00
UBC835	AGAGAGAGAGAGAGAGYC	52	2	1	50.00
UBC836	AGAGAGAGAGAGAGAGYA	52	6	3	50.00
UBC840	GAGAGAGAGAGAGAGAYT	52	5	2	40.00
UBC846	CACACACACACACART	54	4	0	0.00
UBC855	ACACACACACACACYT	55	6	1	16.67
UBC864	ATGATGATGATGATGATG	52	5	0	0.00
UBC866	CTCCTCTCTCTCTCTC	52	5	3	60.00
UBC880	GGAGAGGAGAGGAGA	58	12	3	25.00
UBC889	DBDACACACACACAC	52	7	0	0.00

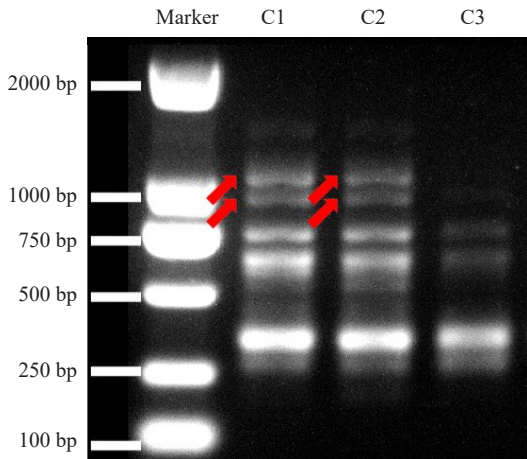


图2 ISSR 引物 UBC840 扩增 3 份桃资源的电泳图谱
Fig. 2 Polymerase chain reaction profiles amplified by ISSR markers UBC840 in 3 accessions

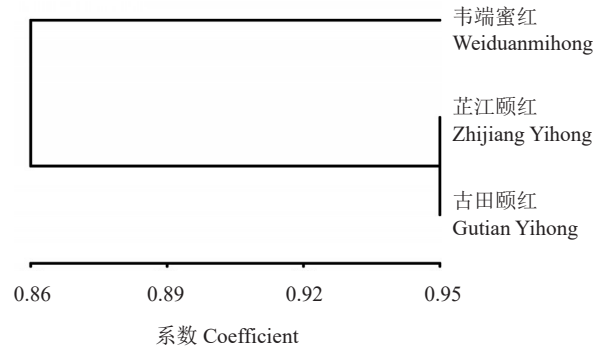


图3 基于 ISSR 标记的 3 份桃资源的 UPGMA 聚类分析树状图
Fig. 3 UPGMA cluster analysis of 3 peach samples based on ISSR Marker

的遗传相似系数为0.86~0.95,当以相似系数0.92为阈值时,分为2类,一类包含韦端蜜红,第二类包含芷江颐红与古田颐红,此时可将韦端蜜红与颐红区分(图3)。韦端蜜红与颐红有相似的遗传背景,在DNA水平上也存在差异,说明韦端蜜红是由颐红芽变而来。

4 栽培技术要点

定植时间在落叶后至萌芽前进行。山地株行距为4 m×4 m,每666.7 m²定植42株;平地株行距

为4 m×5 m,每666.7 m²定植32株。定植穴多用小型挖掘机挖壕沟或人工挖穴,穴规格为1 m×1 m×0.8 m。基肥每株沤肥100~150 kg,钙镁磷2.5 kg,石灰1 kg。选以毛桃为砧木,嫁接口露出地面10 cm左右。苗高要求80~100 cm,以根系发达、无病虫害、单轴无分枝的苗木定植。采果后于10—12月,以有机肥为主,成年树每株施有机肥50 kg,过磷酸钙1 kg,石灰1 kg。

韦端蜜红树喜光,以矮干为主,干高30~50 cm,主枝3枝,均匀排列,开张角度45°。幼龄树修剪应

除强留弱,促进早结果。成年树剪除内膛徒长直立枝,培育长、中果枝,促进立体结果。老龄树疏部分副侧枝,剪除病虫枝、弱枝,多留徒长结果枝,转换主副枝,培育长、中结果枝,逐步更新老弱结果枝,保持强健丰产树势,以延长结果年限。

病虫害以综合防治为主,冬季清园时,剪除病虫枝、枯枝,清除落叶、杂草并集中烧毁,同时喷布 5 °Bé 石硫合剂。雨量多的年份,在萌芽期和展叶期用 72%农用链霉素可溶性粉剂 3000 倍液防治桃细菌性穿孔病。生长期注意防治蚜虫和梨小食心虫,果实成熟前 1 个月停止用药。吸果夜蛾在果实即将成熟时危害较严重,可用频振式杀虫灯、糖醋液诱杀。

5 应用前景

韦端蜜红果实成熟期晚(7月下旬至8月上旬),果大质优,外观艳丽,味甜多汁,酸甜适口,香味浓郁,富含酚类物质,树体产量稳定,品质优良,具有较强的抗逆性,是优质的晚熟桃新品种。成熟期延迟,正值水果生产淡季,经济效益高,适宜在福建桃主产区种植推广。

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