

桃抗再植病障碍砧木中桃抗砧1号的选育

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摘要: 中桃抗砧1号是中国农业科学院郑州果树研究所经过40 a(年)优异种质发掘、杂交育种和多区多点试验等研究, 育成的桃多抗砧木新品种, 亲本为96-7-6(红寿星×乐园)与红根甘肃桃1号。中桃抗砧1号树势健壮, 树姿半开张, 具有抗桃树再植障碍、抗土壤南方根结线虫、耐旱、耐贫瘠等特点, 与各种桃品种嫁接亲和性好, 苗木整齐、健壮, 建立了其无性繁殖技术体系, 在桃产业可持续发展方面有广阔应用前景。

关键词: 桃; 多抗砧木; 中桃抗砧1号; 抗再植障碍; 抗南方根结线虫

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A replantation disease resistant new peach rootstock cultivar Zhong Tao Kang Zhen No. 1

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Abstract: Due to the short economic life of peach trees, most peach orchards require annual renewal. Thus, we need to overcome the obstacles of peach tree replanting disease. At the same time, we also lack of asexual resistant rootstocks for standardized orchard establishment in the peach industry. We started the breeding program of multi-resistance rootstock since the 1980s. Through multi-generation hybridizations, a replantation disease and *Meloidogyne incognita* resistant rootstock was released. Zhong Tao Kang Zhen No. 1 is a multi-resistance rootstock cultivar, selected from the population between 96-7-6 and Hong Gen Gan Su Tao 1 that were crossed in 1999. The female parent 96-7-6 comes from the population Beijing 2-7×Le Yuan crossed in 1996, and Hong Gen Gan Su Tao 1 was selected from wild resources of *Prunus kansuensis* in 1981. The female parent Beijing 2-7 were selected from the seedlings of the cross population of Hakuho×Hong Shou Xing. The Zhong Tao Kang Zhen No. 1 has 34.23% long bearing branches, 27.93% medium bearing branches, 30.63% short bearing branches, 0.90% bouquet bearing branches, and 6.31% apprentice bearing branches; annual flowering branches have medium anthocyanin color development, 6.07 mm flowering branch thickness, 60.5 flower buds per m, and 2.20 cm internode length. The chilling requirement is about 400 h. In Zhengzhou, flowering starts around 12 March, with an early flowering period that lasts 10 days. The flowers are showy, with orange-red anthers and lots of pollen, and are self-compatible. The fruit matures at mid to late July and the shape is round with little color, acidic flavor and free stone. Zhong Tao Kang Zhen No. 1 has good grafting compatibility with various peach varieties, high root resistance to replanting disorders and southern root knot nematodes, and is drought and infertile tolerant. It has strong resistance to replanting obstacles in both sandy and clayey heavy crops and is characterized by fast growth, vigorous growth,

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non-yellowing leaves and a well-developed root system, with no significant effects on fruit, shape appearance and flavor. From 2010 to 2016, Zhong Tao Kang Zhen No. 1 was used as rootstock to graft Zhong Nong Jin Hui, Zhong You Jin Ming, Zhong Pan 11, Zhong You Pan 7 and Zhong Tao Jin Kui. The grafted parts are smooth, with good affinity. And 2019 to 2020, Zhong Tao Kang Zhen No. 1 was used to graft more than 900 germplasm (including peach, plum and apricot) preserved in the National fruit germplasm repository in Zhengzhou, all of which showed good grafting compatibility and smooth healing at the grafting site. In the spring of 2010, Zhong Nong Jin Hui was grafted by rootstocks of Zhong Tao Kang Zhen No. 1, Xinjiang Mao Tao and GF677. In the second year after planting, Zhong Tao Kang Zhen No. 1 was able to bear fruit, and in the third year it was productive, with a yield of 1760 kg per 666.7 square meters, while Xinjiang Mao Tao rootstock only have a maximum yield of 830 kg per 666.7 square meters in the third year. Zhong Tao Kang Zhen No. 1 and seedlings of Xinjiang Mao Tao rootstocks were used to identify resistance to nematodes for two consecutive years in 2019 and 2020. The results show that Zhong Tao Kang Zhen No. 1 was not damaged by nematodes. Zhong Tao Kang Zhen No. 1 is an interspecific hybrid needs to be propagated asexually by cuttings and tissue culture. The results of comparative rootstocks and regional trials show that Zhong Tao Kang Zhen No. 1 is a rootstock that is resistant to both peach replanting disease. It has good grafting compatibility with various peach varieties and can be used for replanting old peach orchards. However, attention should be paid to controlling the vigorous growth of grafted cultivars to achieve early and abundant yield.

Key words: Peach; Multi-resistance rootstock; Zhong Tao Kang Zhen No. 1; Replantation disease resistance; *Meloidogyne incognita* resistance

桃树经济寿命 15~18 a(年),原址更新再植障碍病严重,主要表现为树体生长缓慢,叶片黄化,根癌病、根结线虫病较为严重。我国桃栽培面积 89.0 万 hm²,每年都有相当面积的老桃园需要更新^[1]。通过选育抗再植病桃砧木品种,克服桃树再植障碍,助力老桃园更新,支撑桃产业可持续发展。同时,通过无性繁殖的桃抗性砧木应用,解决桃产业标准化建园的无性系砧木缺乏问题,实现果园管理的标准化、机械化和省力化,提高桃产业市场竞争力。

1 选育过程

中国农业科学院郑州果树研究所 1980 年从甘肃庆阳收集了一批野生种质资源,1981 年开始在抗性鉴定圃开始抗性鉴定,1985 年开始进行盆栽控制性试验^[2-3];其后一系列的研究发现红根甘肃桃 1 号对南方根结线虫免疫,并呈现主效基因控制的显性遗传特点^[4];红寿星桃对南方根结线虫高抗且对桃蚜高抗^[5]。后期研究表明,红根甘肃桃 1 号对根癌病具有一定抗性^[6-8]。

1996 年利用红寿星桃的后代北京 2-7 与乐园杂交,获得优株 96-7-6;1999 年以 96-7-6 为母本,以红

根甘肃桃 1 号为父本杂交,获得其后代实生苗 33 株;2000 年定植在郑州果树研究所白桃园(重茬 2 次),同时种植的还有 1999 年杂交实生苗 1500 多株。当年冬天发现有 1 株长势健壮,较同期其他植株明显粗壮,暂命名为旺株 2 号。2010 年挖取旺株 2 号进行根接试验,同时选取新疆毛桃、红花山桃、红根甘肃桃 1 号等实生砧木为对照,统一嫁接早熟油桃品种中农金辉,并栽植在沙壤重茬地,进行 12 a 砧木比较试验;数据分析结果表明旺株 2 号在重茬试验地块生长势强,较通常使用的砧木生长量大,对接穗果实没有不良影响,有较强的抗再植障碍能力。随后,经过在河南温县、新乡县、西华县,四川简阳市,山东蒙阴县,新疆昆玉等多地试验,与生产中普遍应用的毛桃砧木相比,表现较强的抗再植障碍能力和抗瘠薄能力。同时,开展了其无性繁殖研究,通过组织培养和扦插繁殖研究,解决了其无性繁殖问题,具备了向生产上进行规模化推广的条件。2019 年旺株 2 号命名为中桃抗砧 1 号,系谱见图 1。2021 年获得植物新品种权(CNA20191000108),2022 年通过河南省林木品种委员会审定(豫 S-SV-PP-006-2022),2023 年通过农业农村部非主要农作物品种登记[GPD 桃(2023)410005]。

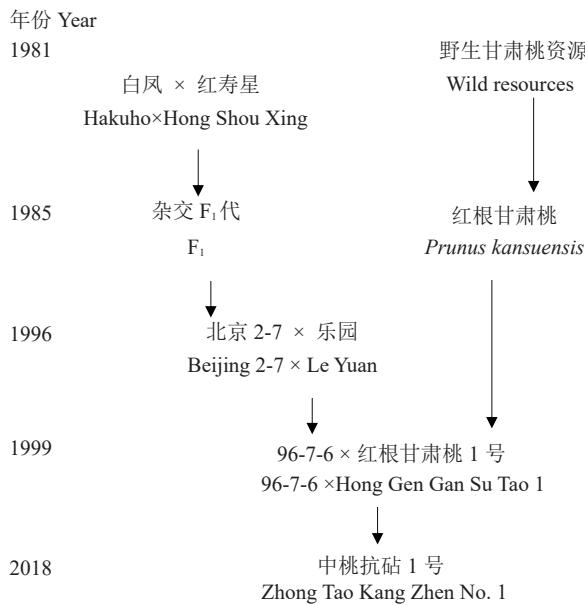


图1 中桃抗砧1号系谱

Fig. 1 The pedigree of Zhong Tao Kang Zhen No. 1

2 主要农业生物学性状

中桃抗砧1号树势健壮,树姿半开张。长中短果枝均能结果,其中长果枝占34.23%,中果枝占27.93%,短果枝占30.63%,花束状果枝占0.90%,徒长性果枝占6.31%;1年生花枝花青苷显色程度中,花枝粗度6.07 mm,花芽密度60.5个·m⁻¹,节间长度2.20 cm。需冷量约400 h。

在郑州地区,中桃抗砧1号2月底3月初花芽膨大,3月12日左右始花,开花期早,开花持续期10 d。花蔷薇型,花药橘红色,花粉多,自花结实。果实7月中下旬成熟,果实圆形,果顶平,果实小,成熟时少量着色,风味酸,离核。

中桃抗砧1号与各种桃品种嫁接亲和性好,根系高抗再植障碍和南方根结线虫,耐旱、耐瘠薄。在沙土重茬地和黏土瘠薄重茬地均具有较强的抗再植障碍能力,表现为生长快、长势旺、叶片不黄化和根系发达的特点,对果实大小、形状和风味无不良影响。

3 嫁接试验及适应性评价

3.1 嫁接亲和性试验

2010—2016年,中桃抗砧1号作为砧木,嫁接中农金辉、中油金铭、中蟠桃11号、中油蟠7号和中桃金魁等多个品种,嫁接部位光滑,无大小脚现象,亲和性良好(图2)。2019—2020年,嫁接国家种质资

源圃郑州桃圃保存种质900余份种质(包括桃、李、杏),均表现嫁接亲和性良好,嫁接口部位愈合光滑,目前全部结果,无不良影响。



图2 中桃抗砧1号与接穗亲和性

Fig. 2 The compatibility of rootstocks Zhong Tao Kang Zhen No. 1 with scion

3.2 砧木比较试验

2010年春天,开展中桃抗砧1号与生产上普遍使用的新疆毛桃、山桃以及欧美广泛使用的抗再植障碍品种GF677砧木在沙土重茬地比较试验,接穗品种为中农金辉油桃。中桃抗砧1号嫁接苗木,栽植后第2年就能挂果,第3年实现丰产(图3),每666.7 m²产量可达1760 kg,其他3种砧木的树体,仅新疆毛桃1号因生长势过弱促生花芽,第2年能见果,第3年最高产量每666.7 m²不超过830 kg(图4,表1)。中桃抗砧1号做砧木,树体整齐度高,生长量大,树势强旺,能够连续实现树体稳产,作为桃树重茬地砧木,优势显著。

3.3 抗根结线虫鉴定试验

2019—2020年连续两年利用南方根结线虫病圃分别对中桃抗砧1号无性系砧木苗和作对照的新疆毛桃实生砧木苗根系进行抗线虫鉴定,结果表明中桃抗砧1号不被线虫危害,根系无根结产生,具有抗南方根结线虫的能力,而新疆毛桃受到线虫危害,根系有较多根结,不抗南方根结线虫(表2,图5)。基因鉴定表明(图6),中桃抗砧1号含有红根甘肃抗桃南方根结线虫关键基因Pkm1的抗性等位变异。

4 繁殖技术要点

中桃抗砧1号为种间杂种,实生后代性状分离严重,需采用扦插繁殖和组织培养等无性繁殖。



图3 中桃抗砧1号砧木上的中农金辉丰产状

Fig. 3 The yield status of Zhong Nong Jin Hui on rootstock of Zhong Tao Kang Zhen No. 1



图4 普通砧木(新疆毛桃)(左)与中桃抗砧1号(右)2年生苗木重茬地区域试验

Fig. 4 The common rootstock (Xin Jiang Mao Tao) (Left) and regional trial Zhong Tao Kang Zhen No. 1 (Right) in continuous cropping land

表1 不同砧木的中农金辉前4年单株产量比较

Table 1 The yield status of Zhong Nong Jin Hui on different rootstocks kg

砧木品系 Cultivar	2013年 In 2013	2014年 In 2014	2015年 In 2015	2016年 In 2016
中桃抗砧1号 Zhong Tao Kang Zhen No. 1	1.21 a	21.21 a	18.50 a	19.01 a
GF677	0.00 c	0.67 d	9.45 c	13.07 b
红花山桃1号 Hong Hua Shan Tao 1	0.00 c	6.04 c	12.48 b	19.58 a
新疆毛桃1号 Xin Jiang Mao Tao 1	0.52 b	9.94 b	9.04 c	12.69 b

注:不同小写字母表示差异显著 $p < 0.05$ 。Note: Different small letters mean significant difference $p < 0.05$.

表2 中桃抗砧1号与新疆毛桃苗木抗南方根结线虫比较

Table 2 The Comparison of resistance to southern root-knot nematode between Zhong Tao Kang Zhen No. 1 and Xin Jiang Mao Tao

试验材料 Cultivar	带根结植株占比 Percentage of root knots/%		苗木类型 Type
	2019年 In 2019	2020年 In 2020	
中桃抗砧1号 Zhong Tao Kang Zhen No. 1	0	0	无性系苗 Asexual seedling
新疆毛桃 Xin Jiang Mao Tao	83	100	种子实生苗 Seedling from seed



左. 根系无根结;右. 根系有很多米粒状根结。
Left. Root system without root knots; Right. Root system with many rice-grain root knots.

图 5 中桃抗砧 1 号(左)与新疆毛桃(右)南方根结线虫抗性鉴定

Fig. 5 The result of resistance to southern root-knot nematode on Zhong Tao Kang Zhen No. 1 (Left), and Xin Jiang Mao Tao (Right)

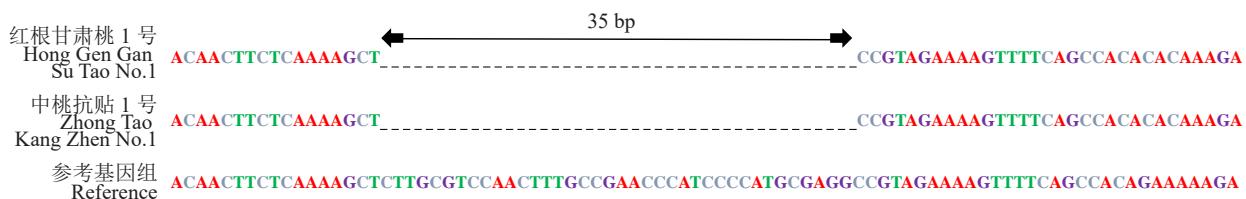


图 6 中桃抗砧 1 号抗南方根结线虫基因型鉴定
Fig. 6 Genotyping of the PkMi locus for Zhong Tao Kang Zhen No. 1

5 综合评价

砧木比较试验和区域生产试验结果表明,中桃抗砧 1 号是一个既抗桃树再植障碍,又抗南方根结线虫的砧木,适合于多种土壤条件的桃砧木。在重茬地应用,显著优于生产中普遍应用的新疆毛桃和山桃。中桃抗砧 1 号与各种桃品种嫁接亲和性良好,可应用于老旧桃园的更新再植,标准化建园,在桃产业可持续发展方面具有广阔的应用前景。在栽培时,注意适度控制嫁接苗旺长,达到早期丰产的目的。

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