

‘ZhongPan 101’ and ‘ZhongPan 102’: Two Flat Peach Cultivars From China

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Flat peach [*Prunus persica* (L.) Batsch var. *platycarpa*] is a variant of ordinary peach with a unique flat shape. It is well known for its shape and delicious fruits (Miao et al. 2022). Although flat peach has a long history of cultivation in China, until the beginning of the 20th century, flat peach was only distributed as a minor variety in the main peach-producing areas of China. In terms of flat peach cultivars, only 46 of the 709 peach cultivars listed in *Peach Genetic Resource in China* (Wang et al. 2012) are flat peach cultivars, and most of them are flat landraces. Several problems have been noted previously in flat peach cultivars, including poor closure of the blossom end (blossom-end scarring in mild cases and cracking in severe cases), cracked stone in some cultivars (loss of commercial value in severe cases), nonsymmetrical fruit shape, small flesh, and low yield (Wang 2021). Many of the shortcomings of flat peach cultivars are intrinsic problems of the cultivars, which are difficult to improve through cultivation measures. This is the key factor limiting the large-scale promotion of flat peach cultivation in China.

For many years, peach breeders in China have been devoted to the genetic improvement of flat peach, and some improved flat peach cultivars have been released, for instance, ‘Pocket Zaoban’ (Jiang et al. 2007) and ‘124 Pantao’ (Ma et al. 2003). However, problems persist in these cultivars, including small fruits, soft flesh, and blossom-end cracks. Only a few flat peach cultivars have good overall performance. In recent years, the Zhengzhou Fruit Research Institute (ZFRI), Chinese Academy of Agricultural Sciences (CAAS), identified genetic sources of flat peach with slow or nonmelting flesh, a well-closed blossom end, and little or no cracking. They were hybridized with high-quality peach and nectarine cultivars or selections. After multiple generations of improvement, breakthroughs

were made in early flat peach breeding, and a series of flat peach cultivars with excellent comprehensive traits have been produced. These cultivars are favored by fruit farmers in the main peach-producing areas in China. Hence, the main problems in flat peach cultivation are expected to be solved, which will help expand the cultivation area of flat peach.

‘ZhongPan 101’ and ‘ZhongPan 102’ are two yellow-flesh flat peach cultivars released from the ZFRI, CAAS. These two cultivars produce large, well-shaped, high-quality fruits with a completely closed stylar end and high yield. Three years of evaluation has confirmed that the peach trees of the two cultivars are stable. ‘ZhongPan 101’ and ‘ZhongPan 102’ were well adapted to climate of the middle and lower reaches of the Yellow River; have performed well in Henan, Jiangsu, and Anhui Provinces; and are suggested for trial wherever ‘ZhongYouPan 9’ is grown.

Origin

‘ZhongPan 101’ resulted from a cross made in 2011 at ZFRI, using the white-fleshed nectarine cultivar CN15 (Pan et al. 2021) from ZFRI as the female parent and a high-quality flat peach selection ‘01-77-3’ from ZFRI as the male parent. ‘01-77-3’ resulted from ‘97-5-31’ × ‘97-2-14’; ‘97-5-31’ is a high-quality nectarine selection, and ‘97-2-14’ is a high-quality flat peach selection with yellow flesh. ‘97-5-31’ was from a cross between the high-quality peach selection ‘Bei Jing 2-7’ and the high-quality nectarine selection ‘NF9260’, and ‘97-2-14’ was a selection from the cultivars Hong Shan Hu (Wang et al. 1996) and Shu Guang (Zong et al. 1995). ‘ZhongPan 102’ resulted from a cross made in 2011 at ZFRI, using the high-quality flat peach selection ‘99-42-41’ as the female parent and the white-fleshed nectarine cultivar CN13 (Niu et al.

2017) as the male parent. ‘99-42-41’ was derived from the midlate peach landrace ‘Feng Bai’ and selection ‘NF9260’. The original seedling trees of ‘ZhongPan 101’ and ‘ZhongPan 102’ were designated ‘DY7-4-29’ and ‘DY11-16-42’, respectively, when planted at the breeding nursery of ZFRI in 2012. These were selected and evaluated in subsequent years with these identifiers (Fig. 1).

Description

‘ZhongPan 101’ and ‘ZhongPan 102’ trees are moderately vigorous and semiupright. Both cultivars have showy, self-fertile, five-petal pink flowers, requiring ~600 h of chilling below 7.2°C to break bud dormancy in Zhengzhou, China. The flesh of both cultivars is sweet, aromatic, firm, and melting, with low acidity after tree ripening (Table 1). During the entire evaluation period from 2016 to 2018 in Zhengzhou, almost no symptoms of bacterial spot (*Xanthomonas arboricola* pv. *pruni*) were observed in the fruits or leaves. In addition, no visible virus symptoms were observed in the leaves of the test trees in all experimental fields from 2016 to 2018 in Zhengzhou.

Performance

The original self-rooted seedlings of ‘ZhongPan 101’ and ‘ZhongPan 102’ planted in the breeding nursery were used for evaluation. After selection, these two cultivars were then grafted onto the peach landrace ‘Mao Tao’, which is the most used rootstock cultivar in China. Several trials with five replicates each were in different climate zones of the Henan Province, Shanxi Province, and Anhui Province. Trees of the two new cultivars ZhongPan 101 and ZhongPan 102, and the reference cultivar ZhongYouPan 9 were grown in the same peach orchard. One-year-old grafted trees were planted in 2012 and spaced 1.5 m in row by 4.5 m between rows. The trees received standard peach orchard management. The orchard was irrigated two to four times per month from flowering to the end of the harvest period. The flower intensity of all the varieties was high, therefore, and the trees needed thinning at full bloom. The trees also needed fruit thinning to optimize the fruit size. The evaluations of the cultivars (ZhongPan 101 and ZhongPan 102) and control (ZhongYouPan 9) from 2016 to 2018 showed excellent commodity quality in 3-year-old trees. Table 1 shows a summary of the 3-year average data for Zhengzhou,

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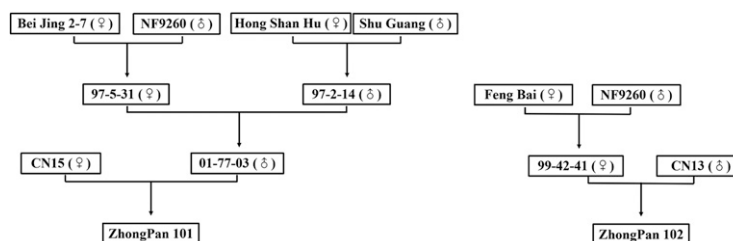


Fig. 1. Pedigrees of the two flat peach cultivars ZhongPan 101 and ZhongPan 102. The left side is the seed parent, and the right side is the male parent in the same cross.

Table 1. Agronomic and fruit quality characteristics of the flat peach cultivars ZhongPan 101, ZhongPan 102, and reference commercial cultivar ZhongYouPan 9 trialed at Zhengzhou, People's Republic of China, from 2016 to 2018. Values are means \pm SD (n = 25). Data represent the mean of 3 years of experiments (2016–18).

| Trait | ZhongPan 101 | ZhongPan 102 | ZhongYouPan 9 ⁱ |
|---|----------------------|----------------------|----------------------------|
| Tree vigor | Medium | Medium | Medium |
| Tree habit | Upright to spreading | Upright to spreading | Upright to spreading |
| Flowering period | 19–26 Mar | 18–26 Mar | 19–24 Mar |
| Flower density | Medium | Medium | Medium |
| Harvest period | 16 Jun–23 Jun | 25 Jun–3 Jul | 1 Jul–7 Jul |
| Fruit development period (tree-ripe days) ⁱⁱ | 86–93 | 95–103 | 101–107 |
| Yield (kg/tree) | 41.6 \pm 2.2 | 52.8 \pm 3.6 | 48.5 \pm 2.9 |
| Dominant fruit size (mm) | 70–75 | 80–85 | 80–85 |
| Average fruit weight (g) | 155 \pm 3.5 | 224 \pm 3.9 | 237 \pm 4.6 |
| Flesh color | Yellow | Yellow | Yellow |
| Flesh firmness (N) | 40.2 \pm 2.4 | 50.9 \pm 3.6 | 59.2 \pm 2.4 |
| Soluble solids ($^{\circ}$ Brix) | 12.5 \pm 0.16 | 13.8 \pm 0.30 | 14.0 \pm 0.27 |
| Acidity (g·L ⁻¹ malic acid) | 3.1 \pm 0.06 | 3.5 \pm 0.04 | 3.8 \pm 0.06 |
| Flesh texture | Melting | Melting | No-melting |
| Flavor ⁱⁱⁱ | Moderate | Moderate | Moderate |
| Red blush (%) | 80–100 | 60–80 | 80–100 |
| Blossom cavity closure | Excellent | Excellent | Excellent |
| Blossom-end cracks ^{iv} | NO | Very few | Very few |
| Postharvest performance ^v | Good | Good | Good |

ⁱ Reference cultivar.

ⁱⁱ Days from full bloom to physiological ripening.

ⁱⁱⁱ Classification based on fruit performance on trees: moderate flavor relative to soluble solids $12 \leq (^{\circ}\text{Brix}) \leq 15$; gentle flavor is $(^{\circ}\text{Brix}) < 12$; and intense flavor is $15 < (^{\circ}\text{Brix})$.

^{iv} Classification based on fruit performance on trees: NO indicates that blossom-end cracks (%) were not observed; Very few indicates $0 < \text{blossom-end cracks} (\%) \leq 5$; Few indicates $5 < \text{blossom-end cracks} (\%) \leq 10$; Much indicates $10 < \text{blossom-end cracks}$.

^v Postharvest performance: good (<25% of total fruits showed mealiness and/or internal browning symptoms); moderate (25% to 50% of total fruits showed mealiness and/or internal browning symptoms); and poor (>50% of total fruits showed mealiness and/or internal browning symptoms).

Henan Province. GPS coordinates: 35°7'N and 113°46'E at an average elevation of 104 m.

Maturation Time

'ZhongPan 101' is an early-maturing cultivar, and its fruit development period is ~86 to 93 d. Under our experimental conditions, the tree-ripe date of 'ZhongPan 101' was about 20 Jun, which was ~2 weeks earlier than that of 'ZhongYouPan 9'. 'ZhongPan 101' fills the gap in yellow-fleshed flat peaches maturing in mid-June in Zhengzhou, People's Republic of China (PRC) (Table 1).

'ZhongPan 102' is an early- to middle-maturing cultivar, and its fruit development period is ~95 to 103 d. Under our experimental conditions, the tree-ripe date of 'ZhongPan 102' was between the end of June and the beginning of July, between

'ZhongPan 101' and 'ZhongYouPan 9' in Zhengzhou, PRC (Table 1).

Fruit Size, Firmness, and Color

At the tree-ripe stage, the fruits of 'ZhongPan 101' were oblate and symmetrical, with sparse short pubescence, a substantially concave blossom end, skin with a yellow undertone, and yellow flesh. All fruit surfaces were 80% to 100% bright red (Fig. 2). The fruit sizes of 'ZhongPan 101' were between 70 and 75 mm, the average fruit weight was 155 g, and the average firmness was 40.2 N (Table 1).

The fruits of 'ZhongPan 102' were oblate and symmetrical, with sparse short hairs, a substantially concave blossom end, skin with a yellow undertone, and yellow flesh. Sixty percent to 80% of the fruit surfaces presented a light red color (Fig. 3). 'ZhongPan 102'

fruits are more attractive in terms of peel color than 'ZhongPan 101' fruits based on these traits. The fruit sizes of 'ZhongPan 102' were between 80 and 85 mm, the average fruit weight was 224 g, and the average firmness was 50.9 N (Table 1). 'ZhongYouPan 9' (Wang et al. 2020) is also a flat nectarine variety with good performance released by ZFRI-CAAS. It was selected as a control variety because it is a flat nectarine with a ripening day close to that of 'ZhongPan 102'. All the fruit evaluated had perfect blossom cavity closure and no or very few blossom-end cracks, which can prevent postharvest problems caused by fungal infections.

Fruit Organoleptic Characteristics

At the tree-ripe stage, the fruits of 'ZhongPan 101' and 'ZhongPan 102' reached maximum sweetness, and the average sweetness was 12.5° Brix for 'ZhongPan 101' and 13.8° Brix for 'ZhongPan 102'. The acidity of the fruits of both cultivars was very low (3.1 and 3.5 g/L malic acid, respectively) (Table 1). The juicy fruits had the unique aroma of peaches.

Availability

'ZhongPan 101' and 'ZhongPan 102' are the property of ZFRI-CAAS and have been approved by the Approval Committee for Improved Varieties of Forest Tree of Henan Province (No. Henan S-SV-PP-003–2021 and S-SV-PP-004–2021, respectively). A limited quantity of bud wood is available upon request for trial and research purposes and commercial propagation. Requests for budwood should be directed to Zhengzhou Fruit Research Institute of Chinese Academy of Agricultural Sciences, 28 Gangwan Road, Guancheng Hui District, Zhengzhou, Henan Province, Zhengzhou City, People's Republic of China.

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Fig. 2. 'ZhongPan 101' peach fruit.

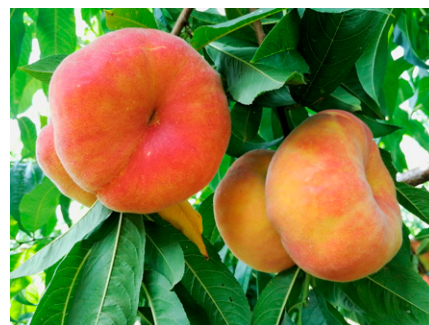


Fig. 3. 'ZhongPan 102' peach fruit.

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