‘Ruiyang’, A Late-ripening Apple

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‘Ruiyang’ is a new late-ripening apple cultivar notable for its high fruit quality and good productivity. ‘Ruiyang’ originated from a controlled cross of ‘Qinguan’ × ‘Fuji’. Similar to ‘Qinguan’, ‘Ruiyang’ has a spreading habit and high resistance to Marssonina leaf blotch [*Marssonina coronaria* (Ell. et Davis) Davis]. Unlike ‘Fuji’, ‘Ruiyang’

has consistent high productivity with precocious fruit bearing and no tendency to biennial bearing. The fruit is medium-large with a smooth, uniform dark-red skin color. The fine, crispy and juicy flesh is yellowish-white with an excellent flavor. The taste is similar to ‘Fuji’ but slightly sweeter and more fragrant. It has a long storage capacity and

shelf life. The aim of this work is to provide detailed information on the new apple cultivar Ruiyang, including habits, fruit quality, disease resistance, and a comparison to its parent cultivars.

Origin

‘Ruiyang’ is the result of cross between ‘Fuji’ (male) and ‘Qinguan’ (female) carried out at a farmer orchard in Li-quan county, Shaanxi, China. The objective of the breeding program was to combine the good fruit quality of ‘Fuji’ (Fu, 1989) with the good habit and resistance to Marssonina leaf blotch of ‘Qinguan’ (Wen, 1980), thus developing new apple varieties to replace ‘Fuji’, which accounts for ≈70% of apple production in China (Zhao, 2015) but is difficult to manage. In 2004, 5730 seeds were collected and

Table 1. Average values of the physico-chemical parameters detected on ‘Ruiyang’ apples under cold-storage condition of cold storage.

Varieties	Storage time (d)											
	0				90				180			
	Firmness kg/cm ²	SSC %	TAC mg/100 g	Vit C mg/100 g	Firmness kg/cm ²	SSC %	TAC mg/100 g	Vit C mg/100 g	Firmness kg/cm ²	SSC %	TAC mg/100 g	Vit C mg/100 g
Ruiyang	7.21	16.5	0.28	8.83	6.27	17.7	0.27	8.75	5.89	16.3	0.24	8.30
Fuji	8.33	13.9	0.32	8.27	6.24	15.7	0.21	8.18	5.78	15.1	0.17	7.76
Qinguan	9.66	14.2	0.27	9.15	5.69	15.6	0.23	8.86	3.57	14.5	0.21	8.14

SSC = soluble solids concentration; TAC = titratable acid concentration; TSC = total sugar concentration; Vit C = vitamin C.

Fig. 1. Average values of the physico-chemical parameters detected on ‘Ruiyang’ apples under cold-storage conditions.

Fig. 2. Yield of 'Ruiyang' in three regions of Shaanxi, China.

Table 2. Yield of 'Ruiyang'.

	Baishui (kg/ha)			Xunyi (kg/ha)			Fufeng (kg/ha)		
	Ruiyang	Qinguan	Fuji	Ruiyang	Qinguan	Fuji	Ruiyang	Qinguan	Fuji
2012	16,541.6	18,209.1	2,467.9	13,740.2	12,539.6	1,800.9	14,740.7	18,342.5	3,335.0
2013	91,779.2	94,914.1	14,807.4	77,772.2	79,106.2	13,806.9	84,508.9	100,850.4	53,360.0
2014	135,601.1	126,796.7	74,904.1	112,056.0	105,386.0	68,167.4	143,938.6	131,665.8	100,050.0
Average	81,307.3	79,973.3	30,728.7	67,853.9	65,679.5	27,927.3	81,060.5	83,621.8	52,246.1

Baishui is in the south of Loess Plateau (lat. 109°16' to 109°45' E; long. 35°4' to 35°27' N). Xunyi is in the west-middle of Shaanxi (lat. 108°08' to 108°52' E; long. 34°57' to 35°33' N). Fufeng is in the west-middle of Shaanxi (lat. 107°87' E; long. 34°37' N).

germinated. In 2005, 2365 seedlings were obtained. In 2009, 'Ruiyang', named as '6B1-4' at that time, was selected from a population of seedlings derived from its parents and other populations, and it was chosen for its attractive red color, excellent fruit quality, and good growing habit. In 2010, a 4-year evaluation of tree growth yield and fruit quality of '6B1-4' was carried out in the major apple production areas of China. After evaluation and approval by the Fruit Cultivar Approval Committee of Shaanxi Province, '6B1-4' was named 'Ruiyang' and

released in 2015, detailed reports about 'Ruiyang' first published in foreign countries.

Description

Tree. According to *Apple Descriptor* (Watkins and Smith, 1982), 'Ruiyang' exhibits intermediate tree vigor with a spreading/drooping habit when grafted on M.26. The trunk is smooth, gray-brown (410C), and the branches are purple brown (411C). One-year-old shoots are upright, reddish brown (483C) with medium-dense, small, mounted, round lenticels, and their internodes are 20.3 mm long. Pubescence on young and autumn shoots is medium. The vegetative buds are triangular, small in size, and moderately pubescent, whereas flower buds are plump, wedge-shaped, and pubescent.

Leaf. The leaf is oval, medium-thick, small, and 7.95 cm long and 4.35 cm wide;

the color of its upper surface is green (357C), and the lower surface is pubescent. The blade margin of the leaf is serrated, and the altitude in relation to the shoot is less than 90°.

Fruit. The physical appearance of 'Ruiyang' has a number of advantages over 'Qinguan' and 'Fuji' (Wang, 2016), including more regular fruit shape and smooth, attractive, uniform red skin color. 'Ruiyang' also has a much better fruit texture than its parent 'Qinguan'. In short, 'Ruiyang' has many advantages over its parent cultivars, including good taste and fragrance and improved shelf life. Therefore, it has great potential to compete and reduce the quantity of 'Fuji' on the market.

The fruit shape is medium-conical with a fruit shape index of 0.84 (Watkins and Smith, 1982). The fruit is medium-large in size with an average fruit weight of 282.3 g. Skin color is bright dark red (711C) over

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Table 3. The result of inoculation of Marssonina leaf blotch.

	Ruiyang	Qinguan	Fuji	Pink Lady	Golden Delicious	Ourin
Sensitivity index	4.2	1.3	45.2	14.0	19.7	16.6

Table 4. The research result of powdery mildew.

	Ruiyang	Qinguan	Fuji	Pink Lady	Golden Delicious	Ourin
Sensitivity index	31.83	19.38	10.87	36.45	16.83	64.57

a yellow-green (372C) ground color, and the over color type is complete over color (according to Pantone Color Lab, RGB, and Hex). The fruit surface is smooth and bright with no russet, but small, light brown (110C) lenticels of medium density. The stalk is medium-long, medium in diameter, and the depth of stalk cavity is flat, medium in size with no russet. The eye basin is wide but shallow, with a small, upright, prominent calyx. The core is oval, symmetrical, small in size, and located in the median position. There are five small oval locules. The flesh is yellowish-white, fine, and juicy. The flavor is good, aromatic, sweet, and slightly tart. At the time of harvest, soluble solids concentration, total sugar concentration, titratable acid concentration, vitamin C concentration, and fruit firmness averaged 16.5%, 14.0%, 0.33%, 8.83 mg/100 g, and 7.21 kg/cm², respectively (Table 1). During the storage period, the indexes of ‘Ruiyang’ decreased slowly compared with other cultivars, showing that it has a longer shelf life (Fig. 1).

Phenology. In the middle Weibei Loess Plateau (lat. 109°16′ to 109°45′ E; long.

35°4′ to 35°27′ N), budbreak of ‘Ruiyang’ begins in late March, almost at the same time as ‘Fuji’ and ‘Qinguan’; flowering begins a few days later than ‘Fuji’ and ‘Qinguan’, and fruit matures 3 to 5 d earlier than ‘Fuji’ and ‘Qinguan’. The fruit development period is 103 d, and leaf fall starts in late November.

Performance. Results from a 3-year evaluation showed that ‘Ruiyang’ is well adapted in all three test areas in Shaanxi province (Fig. 2). Similar to ‘Qinguan’, ‘Ruiyang’ begins blooming and fruiting in the second year after graft, whereas ‘Fuji’ begins to fruit in the third year after graft. ‘Ruiyang’ also exhibits higher productivity than ‘Fuji’ (Table 2).

Resistance. Similar to ‘Qinguan’, ‘Ruiyang’ exhibited high resistance to Marssonina leaf blotch [*Marssonina coronaria* (Ell. et Davis) Davis]. In 2013 and 2014, the host species of ruiyang cultivars were continuously studied for the inoculation of Marssonina leaf blotch and disease occurrence in the field. The results showed that ‘Fuji’ was the most severely affected and was susceptible or highly susceptible to it, whereas ‘Qinguan’ and ‘Ruiyang’

were mildly affected by Marssonina leaf blotch (Wang, 2016), showing high resistance (Table 3). In 2014, the incidence of powdery mildew was investigated in Baishui, which is in the south of the Loess Plateau, and the results showed that ‘Fuji’ has the highest resistance, followed by ‘Golden Delicious’, ‘Qinguan’, ‘Ruiyang’, and ‘Pink Lady’, whereas ‘Ourin’ has the lowest resistance (Table 4).

Availability

An application will be made to protect ‘Ruiyang’ nationally in China. Trees and bud wood under rules of international Plant Variety Rights are available for research purposes, which can be obtained from the authors (Zhao or Gao) at the College of Horticulture, Northwest A&F University, Yangling, Shaanxi, China.

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