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A Blackcurrant (*Ribes nigrum* L.) Cultivar: Wanfeng

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'Wanfeng' is a new late-ripening and winter-hardy blackcurrant (*Ribes nigrum* L.) cultivar. 'Wanfeng' produces medium, attractive, and good-quality fruit that can be used for blackcurrant juices and frozen fruit. In China, the Mudanjiang Branch of Heilongjiang Academy of Agricultural Sciences, Jilin Agricultural University, Northeast Agricultural University, and other units began the applied breeding of blackcurrants in 1980. Many blackcurrant cultivars have been released since that time, such as 'Hanfeng', 'Zaofeng', 'Danjianghei', 'Daisha', 'Suiyan-1', and so on (Li et al. 2012). 'Hanfeng' is the first distant hybrid blackcurrant cultivar with strong winterhardiness in China, which solves the problem of the lack of winter-hardy blackcurrant cultivars in commercial cultivation and fruit production. 'Wanfeng' is a descendant of 'Hanfeng'. The breeding program is still active and new clones are under intensive evaluation. New cultivars are being released as well.

Origin

'Wanfeng' was selected among seedlings derived from the crossing of 'Hanfeng' × 'Fertödi-1' (pedigree shown in Supplemental Fig. 1). Both parental forms differ widely in terms of their pedigree, geographic origin, and many agronomic features. The female parent 'Hanfeng' was derived from a cross between 'Liangyehoupi' and *Ribes pauciflorum* Turcz. In the eastern and southern parts of Heilongjiang Province, fruit ripening of 'Hanfeng' is midseason (usually 15–20 Jul). The plant is moderately productive, and the fruit is medium in size (0.8–1.0 g) on long strigs. High winterhardiness and low susceptibility to powdery mildew (*Sphaerotheca morsuvae* Schwein./Berk. et Curt.) and leaf spot (*Drepanopeziza ribis* Kleb. Petrak.) are its main advantages in breeding and cultivation. 'Fertödi-1' was obtained in Hungary. The earliness and evenness of ripening, as well as the good taste of the fruit and pretty high yields are the main advantages of 'Fertödi-1'. However, its disadvantage is the high susceptibility of the plants to fungal diseases such as powdery mildew and leaf spot.

In 1990, W. Zhou pollinated 'Hanfeng' with the pollen of 'Fertödi-1' and obtained 1360 seeds. The seeds were sown in the Berry Experimental Orchard at the Mudanjiang Branch of Heilongjiang Academy of Agricultural Sciences in May 1991, and the 54 obtained seedlings were labeled Muyu90-6-1 to 54. Phenotypic evaluation and selection of seedlings in the field was conducted during the fruit-bearing period from 1994 to 1996. muyu90-6-16 exhibited the characteristics of late maturity, winterhardiness, medium-size fruit, and high yield. From 1997 to 2001, muyu90-6-16 passed regional and production trials at several locations: Hailin (lat. 44.3°N, long. 129.2°E), Shangzhi (lat. 44.8°N, long. 128.7°E), Jiamusi (lat. 47.0°N, long. 130.7°E), and Mudanjiang (lat. 44.4°N, long. 129.5°E) (Table 1). In Apr 2002, it was named 'Wanfeng' and registered by the Heilongjiang Provincial Crop Variety Approval Committee. During the evaluation, 'Wanfeng' was tested as selected breeding number muyu90-6-16. The name 'Wanfeng' derives from its late fruit maturity and high productivity.

Description

'Wanfeng' has a semiopen growth habit, strong shrub vigor, many new shoots, and a large plant size. Five-year-old shrubs have an average height of 131 cm and a maximum plant diameter of 139 cm. The annual shoot is grayish brown; the perennial shoot is yellowish brown. The foliage is dark green and has five lobes, with an extended center lobe. The flower is hermaphroditic, and purple-red at the beginning and pink-white in full bloom. There are one to two inflorescences per bud. The fruit are black and round, the flesh is light green, and the seed is brown at the full maturity (Supplemental Fig. 2). Fruit set following self-pollination was 58.7% compared with 74.6% open pollination. 'Hanfeng' and 'Fertödi-1' are also recommended as the pollinizers for high fruit yield in commercial cultivation. 'Wanfeng' exhibits good adaptability to the plains and piedmont regions in Heilongjiang Province, China (accumulated temperature above 0 °C, 1300–1500 °C; annual precipitation, 450–650 mm; soil pH, 6–8), with no necessity for cold-proof management or soil amelioration, such as root covering in winter or soil acidity improvement. The bushes of 'Wanfeng' are winter hardy. However, flower buds, flowers, and fruit sets of 'Wanfeng' suffer from late-spring frosts. 'Wanfeng' is resistant to powdery mildew (*S. morsuvae* Schwein./Berk. et Curt.) and has a low susceptibility to leaf spot (*D. ribis* Kleb. Petrak.). No pests were observed on 'Wanfeng' during the evaluation period. Vegetative propagation is accomplished easily by using softwood cuttings, hardwood cuttings, or tissue culture, with the hardwood cutting recommended most frequently.

Table 2 presents the key phenological period and fruit yield of 'Wanfeng' and reference cultivars at the Mudanjiang Branch of Heilongjiang Academy of Agricultural Sciences (lat. 44.4°N, long. 129.5°E) during 2018–20. The bloom period of 'Wanfeng' is medium-early (6 May), which is 4 d later than 'Kanghanbaopi', 2 d earlier than 'Ben Lomond', and 4 d earlier than 'Öjebyn'. The estimated ripening periods (50% of ripe berries) of 'Wanfeng', 'Kanghanbaopi', 'Öjebyn', and 'Ben Lomond' were 22 Jul, 14 Jul, 14 Jul,

Table 1. Plant growth, fruit size, and susceptibility to leaf diseases of 'Wanfeng' grown in Hailin, Shangzhi, Mudanjaing, and Jiamusi from 1999 to 2001 (N = 30).

				Susceptibility to leaf diseases[i]	
Location	Plant ht (cm)	Plant width (cm)	Weight (g)	Powdery mildew	Leaf spot
Hailin	122.5 ab[ii]	125.9 ab	0.92 a	1.0 a	2.2 a
Shangzhi	123.1 a	126.5 a	0.95 a	1.0 a	2.5 a
Mudanjiang	121.8 b	125.7 ab	0.93 a	1.0 a	2.2 a
Jiamusi	121.5 b	125.5 ab	0.92 a	1.0 a	2.0 a

[i] Ranking scale (1–5), where 1 = no visible symptoms of infection, 3 = moderate infection, and 5 = greatest infection.
[ii] Means within columns marked with the same letter do not differ significantly at $P \leq 0.05$ according to Duncan's multiple range test.

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Table 2. Phenological period and yield of 'Wanfeng', and tested blackcurrant cultivars grown at the Mudanjiang Branch of Heilongjiang Academy of Agricultural Sciences from 2018 to 2020 (N = 30).

Cultivar	Country of origin	Key phenological period[i]		Yield (kg/plant)		
		25% Flower opening date range (3-year avg)	50% Berry ripening date range (3-year avg)	2018 (3 years old)	2019 (4 years old)	2020 (5 years old)
Wanfeng	China	4–9 May (6 May)	19–24 Jul (22 Jul)	0.94 a[ii]	1.45 a	1.98 a
Kanghanbaopi	Russia	29 Apr–4 May (2 May)	10–16 Jul (14 Jul)	0.52 c	0.96 c	1.42 c
Öjebyn	Sweden	8–13 May (10 May)	11–16 Jul (14 Jul)	0.69 b	1.15 b	1.73 b
Ben Lomond	United Kingdom	6–11 May (8 May)	13–18 Jul (16 Jul)	0.70 b	1.21 b	1.78 b

[i] Three years of observation (2018–20) are included in the date range.
[ii] Means within columns marked with the same letter do not differ significantly at $P \leq 0.05$ according to Duncan's multiple range test.

and 16 Jul, respectively. The full fruit maturity of 'Wanfeng' was 6 to 8 d later than other tested cultivars. In this regard, 'Wanfeng' is considered to be a late-ripening cultivar.

From 2018 to 2020, the yield evaluation of 'Wanfeng' at the Mudanjiang Branch of Heilongjiang Academy of Agricultural Sciences was conducted with 30 clumps (an adjacent planting of two clonally propagated plants propagated from cuttings, with between-plant spacing of 20 cm; Supplemental Fig. 2) at a planting density of 8000 plants (4000 clumps)/ha (in-row spacing between clumps, 1 m; between-row spacing, 2.5 m). In the field experiment, three control cultivars—Kanghanbaopi, Öjebyn, and Ben Lomond—were also planted in 2016. The soil type of test plots was Chinese mollisols and the climate type belonged to US Department of Agriculture zone 4a. Annually, 30 t of organic fertilizer (barnyard manure) per hectare was applied every autumn. Drip irrigation time, dose, and frequency were flexibly arranged according to soil moisture. The mature shrub required regular pruning in early spring, each clump retained approximately ten 1-year-old shoots, five to seven 2-year-old shoots, four to five 3-year-old shoots, and one to two 4-year-old shoots. Shoots older than 5 years were removed. The average fruit yields of 3-, 4-, and 5-year-old plants of 'Wanfeng' were 0.94, 1.45, and 1.98 kg/plant, respectively. The average fruit yield of 5-year-old plants of 'Kanghanbaopi' was 1.42 kg/plant, 'Öjebyn' was 1.73 kg/plant, and 'Ben Lomond' was 1.78 kg/plant. 'Wanfeng' is very productive. At a cultivation density of 8000 plants/ha, plants of 'Wanfeng' propagated from hardwood cuttings produced berries for the first time in the second year after planting, and had a yield of close to 2 kg of berries/plant in the fifth year after planting. The yield performance of 'Wanfeng' in the long term (>10 years) remains to be investigated further.

Berry traits and quality are presented in Table 3. The average berry size of 'Wanfeng' was medium (1.15 × 1.15 cm), with an average weight of 0.92 g and a maximum weight of 1.50 g, whereas the average berry sizes of 'Kanghanbaopi' and 'Öjebyn' were small (0.98 × 1.00 and 1.04 × 1.08 cm, respectively); with an average weight of 0.67 and 0.76 g, respectively; and a maximum weight of 1.00 and 1.10 g, respectively. The average fruit weight of 'Wanfeng' (0.92 g) was larger than that of 'Polares' (∼0.62 g) (Pluta and Żurawicz 2015) and smaller than that of 'Ben Lomond' (1.08 g), 'Danjianghei' (2.02 g) (Zhang et al. 2024), and 'Gofert' (∼1.17 g) (Pluta and Żurawicz 2014). 'Wanfeng' is a medium fruit-type blackcurrant. Total soluble solids (TSS) and titratable acidity (TA) were determined by using a pocket Brix-acidity meter (PAL-BX/ACID7; Atago Corp., Tokyo, Japan). 'Wanfeng' (14.96 °Brix) showed significantly greater TSS than 'Kanghanbaopi' (11.28 °Brix) and 'Ben Lomond' (12.96 °Brix). TSS of 'Wanfeng' was greater than that of 'Öjebyn' (14.08 °Brix), but the difference was not significant. TA of 'Wanfeng' (2.59%) was similar to that of 'Kanghanbaopi' (2.50%) and 'Öjebyn' (2.55%). TA of 'Wanfeng' was significantly less than 'Ben Lomond' (3.15%). 'Wanfeng' is very suitable for all processing applications (concentrates, juices, jellies, frozen foods, and other high-quality fruit products) and for individual quick freezing.

In conclusion, 'Wanfeng' is a desirable substitute for 'Kanghanbaopi' in northeastern China, with great commercial value in fruit markets in China, and it might be a candidate cultivar or breeding material in other blackcurrant-producing areas in the world.

Table 3. Average fruit size and selected fruit quality parameters of 'Wanfeng', and tested blackcurrant cultivars grown at the Mudanjiang Branch of Heilongjiang Academy of Agricultural Sciences from 2018 to 2020 (N = 30).

Cultivar	Weight (g)	Vertical diam (cm)	Horizontal diam (cm)	Soluble solid (°Brix)[i]	Acidity (%)[i]
Wanfeng	0.92 b[ii]	1.15 a	1.15 b	14.96 a	2.59 b
Kanghanbaopi	0.67 d	0.98 d	1.00 d	11.28 c	2.50 b
Öjebyn	0.76 c	1.04 c	1.08 c	14.08 a	2.55 b
Ben Lomond	1.08 a	1.10 b	1.19 a	12.96 b	3.15 a

[i] Soluble solids and acidity were determined from three fruit mixture samples with 10 replicates per fruit mixture sample and a total of 30 fruit per cultivar.
[ii] Means within columns marked with the same letter do not differ significantly at $P \leq 0.05$ according to Duncan's multiple range test.

Availability

'Wanfeng' was authorized by the Heilongjiang Provincial Crop Variety Approval Committee in Apr 2002 (certificate no. 2002001). The cultivar is owned and propagated by the Mudanjiang Branch of Heilongjiang Academy of Agricultural Sciences, Mudanjiang, China. Growers may request information about how to obtain nursery plant material by contacting the corresponding author (mdjzwj@126.com). This published genetic material has been deposited at the Mudanjiang Branch of Heilongjiang Academy of Agricultural Sciences, and it is available for research purposes, including the development and commercialization of new cultivars.

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