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‘Black Star’: An Early-maturing Seedless Grape Cultivar

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In Korea, ‘Campbell Early’, ‘Shine Muscat’, and ‘Kyoho’ account for more than 90% of the Korean grape cultivation area (Kim et al., 2021). As a result, the supply of grapes in the Korean market is excessive during a certain period. Consequently, it is difficult to avoid a reduction in the wholesale price, and the opportunity for consumers to experience other grape cultivars becomes limited. In the current scenario, in which imports are occurring rapidly following the recent implementation of the free-trade agreement with Chile and the United States, it is necessary to cultivate various high-quality grape cultivars to enhance the competitiveness of the Korean grape market and consumer satisfaction.

Numerous attempts to develop new grape cultivars have been made by Korean grape breeders (Heo and Park, 2017; Park et al., 2020; Roh et al., 2018). However, none of them were successful in developing a new cultivar that can replace ‘Campbell Early’ as an early-maturing cultivar. Our research team has tried to create useful triploid and aneuploid genetic resources, which have advantages of producing seedless grapes, with varying phenotypes of ripeness, quality, and skin color (Heo and Park, 2016; Kim et al., 2020; Park et al., 2015). As a result, we have finally developed a triploid seedless grape cultivar, Black Star—an early-maturing cultivar with excellent quality and adaptability to relatively unfavorable environments during cultivation.

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Origin

One of the main problems that hampers the breeding of triploid grape cultivars is seed abortion that usually occurs after a planned cross. Heo et al. (2007) reported that in a cross between a tetraploid female and diploid male, a larger number of triploid-viable seeds can be obtained compared with a cross between a diploid female and tetraploid male. Therefore, the tetraploid cultivar Honey Black was selected as the female parent and the diploid cultivar Campbell Early was selected as the male parent to improve the efficiency of triploid seedling production. Subsequently, a planned cross between the two cultivars was made in 2002 at the vineyard of Gangwondo Agricultural Rese arch and Extension Services (GARES) located in Chuncheon, Korea. After the artificial cross, 240 seeds were harvested the same year. Seeds that had broken dormancy were sown at the beginning of the following year to get progenies. Of them, only 12 seeds germinated. The triploidy status of these individuals was confirmed by counting the chromosome number as described by Park et al. (2016). ‘Black Star’, initially named ‘GWT-80’, which was identified as a triploid selection with superior growth characteristics during its early growth stages, was multiplied for evaluation of its vine performance and fruit quality in the

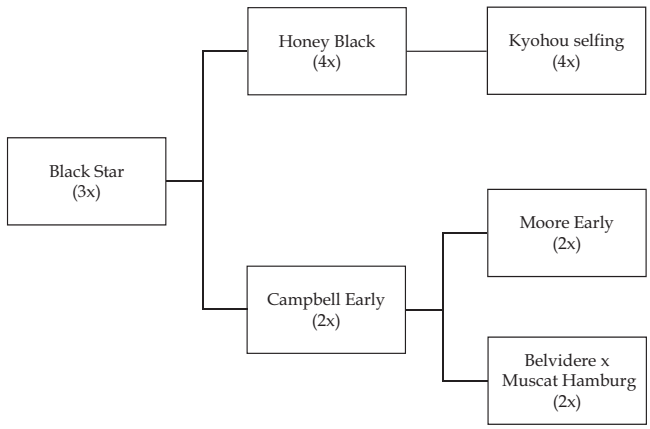

Fig. 1. Pedigree of the ‘Black Star’.

Table 1. Fruit characteristics of ‘Black Star’ and ‘Campbell Early’.

Characteristics[z]	Black Star	Campbell Early
Bud sprouting date	25 Apr.	24 Apr.
Flowering date	5 June	4 June
Maturing date	30 Aug.	5 Sept.
Cluster shape	Conical	Conical
Berry shape	Round	Round
Cluster weight (g)[y]	428.2	345.3
Berry weight (g)[x]	6.5	4.3
Productivity (kg/acre)	8,770.4	7,884.8
Total soluble solids (%)[w]	18.5	13.8
Titratable acidity (%)[v]	0.68	0.45
Ratio of total soluble solids to titratable acidity	36.8	30.7

[z]All values are means investigated from 2009 to 2011 in Chuncheon, Republic of Korea.
[y]Ten clusters from gibberellic acid-treated (100 ppm) vines were sampled randomly from five vines at the optimal harvest period for calculation.
[x]Determined by dividing total fruit weight by the number of berries.
[w]Ten berries were sampled randomly from each cluster.
[v]The titratable acidity is expressed as tartaric acid equivalents.

greenhouse of GARES. Five ungrafted vines were planted at 4 m between rows and 3 m between plants for evaluation of their field performance, and were trained to an overhead arbor. Standard grapevine management practices made by the Rural Development Administration in Korea were applied for pest and disease management. From 2008 to 2011, extensive examination for assessment of growth and fruit characteristics was carried out, and the final selection was made once it was confirmed that 'GWT-80' has attractive traits as a new grape cultivar. It was eventually named 'Black Star', and was applied for receiving Plant Variety Protection from the Korea Seed & Variety Service (KSVS) in 2012. In 2016, it was registered as a new grape variety in Korea (Fig. 1).

Description

'Black Star' is a vigorous cultivar (Table 1). Its growth tends to be intensive, and thus proper canopy management during the growing season is required. Budburst and flowering dates in 'Black Star' are 25 Apr. and 5 June, respectively, which is 1 d later than 'Campbell Early'. However, veraison occurs earlier in 'Black Star' compared with 'Campbell Early', which occurs in late July or the beginning of August The optimal harvest date of 'Black Star' is 30 Aug., and it precedes 'Campbell Early' by 5 d.

The flowers of 'Black Star' are hermaphroditic. However, pollen is not fertile, unlike 'Campbell Early'. The cluster is uniformly shaped and conical (Fig. 2). The berries are round and black. Similar to other triploid grape cultivars, the fruit set is poor without gibberellic (GA_3) treatment in 'Black Star' (Heo and Park, 2015), and a single application of GA_3 at a 100-ppm concentration during full bloom increases the fruit set significantly. After GA_3 application, this cultivar had a good berry set, with 66 berries per cluster. Mean cluster weight and berry weight were 428.2 g and 6.5 g, respectively. The fruit of this cultivar has abundant juice and a soft texture. The berry skin of 'Black Star' is not thick and is relatively susceptible to cracking. Therefore, excessive soil moisture should be avoided.

The average total soluble solids concentration (TSS) of 'Black Star' was 18.5% and titratable acidity (TA) was 0.68% at the harvest. TSS and TA of 'Black Star' were greater than those of 'Campbell Early'. The TSS-to-TA ratio was also much greater than that of 'Campbell Early'. This cultivar showed cold tolerance and did not experience severe damage to buds even when grown under field conditions in a very cold region where the winter temperature drops to less than –20 °C in Korea. During the experimental periods, we observed that gray mold (*Botrytis cinerea*) in 'Black Star' occurred at a low level, but crown gall disease did not occur at all. Hence, bagging and pesticide treatments after GA_3 application are recommended to protect against gray mold. The fruit and vine characteristics of 'Black Star' suggest that it has the potential to satisfy Korean consumers' needs and can be adapted easily in most Korean regions. More importantly, it is an early-maturing grape cultivar with high-quality seedless fruit. It should also be noted that TSS greater than 18% in a grape is considered a superior quality in Korea. Alternative cultivars to 'Campbell Early' as an early-maturing cultivar have not yet been released. Therefore, it is expected that 'Black Star' will become an important early-maturing grape cultivar in Korea.

Fig. 2. Cluster appearance of the 'Black Star'.

Availability

'Black Star' is a patented Korean grape cultivar developed from KSVS and is owned by GARES. It is now cultivated in commercial vineyards located in northern regions, such as Gyeonggi and Gangwon Provinces in the Republic of Korea. Requests for cuttings for research purposes may be addressed to Young-Sik Park (yspark06@korea.kr).

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