‘Mountain Honey’ Hybrid Grape Tomato and Its Parent NC 6 Grape Breeding Line

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‘Mountain Honey’ is a hybrid grape tomato (Solanum lycopersicum L.) resulting from the cross of NC 4 grape × NC 6 grape. It is heterozygous-resistant to fusarium wilt race 3 [Fusarium oxysporum f.sp. lycopersici (Sacc.) Snyder and Hans.], late blight (Ph-2 gene) (Phytophthora infestans (Sacc.) Snyd. and Hans.), and Tomato spotted wilt virus (TSWV) (Sw-5 gene). It has a compact indeterminate plant with short internodes conferred by the brachytic (br) gene and has dark red fruit with high total soluble solids.

Origin

‘Mountain Honey’ F1 hybrid grape tomato resulted from a tomato breeding effort initiated in 2003 to develop a superior hybrid grape tomato similar in plant and fruit type to ‘Smarty’ but with the additions of late blight, fusarium wilt race 3, and TSWV resistances. The resultant hybrid, ‘Mountain Honey’, first crossed in the fall of 2009, was tested as NC 10242 in replicated and observational trials at the Mountain Horticultural Crops Research and Extension Center (MHCREC), Mills River, NC, in 2010–12 and was widely tested in grower plantings in western North Carolina (NC) and in the coastal area of South Carolina (SC).

NC 4 grape shown in the top of the pedigrees in Figure 1 resulted from a breeding effort initiated in 2002 to add resistance genes for TSWV (Sw-5) and fusarium wilt race 3 (I-3) along with other useful traits into a compact, indeterminate growth habit breeding line with short internodes conferred by the brachytic (br) gene. It was described in conjunction with its use as a parent in the ‘Mountain Vineyard’ F1 hybrid grape tomato (Panthee and Gardner, 2013). NC 6 grape resulted from breeding to develop a late blight-resistant, compact, indeterminate, brachytic growth habit grape tomato breeding line that could be used as a parent in a ‘Smarty’-type grape tomato F1 hybrid. ‘Smarty’, resulting from the cross of NC 3 grape × NC 2 grape (Gardner and Panthee, 2010), is a highly successful cultivar that is widely grown. NC 2 grape was used extensively as the source of desirable grape tomato fruit and plant traits in developing NC 6 grape.

NC 2 grape was crossed with 03220 (x)-20, a large-fruited, early blight/late blight-resistant tomato line having the Ph-2 and Ph-3 genes combined for late blight resistance (Fig. 1). The resultant 0463 hybrid was then crossed with 9722 (x)-18, an early blight/late blight-resistant F2 selection derived from backcrossing to introgress the Ph-3 gene for late blight resistance from L 3707 into the early blight-resistant line 215 E-1 (93). The plants from this cross were selected in the F2 generation in the field for late blight resistance in 2005 and then grown in the greenhouse in the F3 generation and identified as late blight-resistant individuals using a detached leaf inoculation test. The resultant 05108 (x)-2-166 F3 selection was crossed to 051 (x)-18 gsms, an F2 selection of NC 6 grape. The F4 generation was grown in the greenhouse in the fall of 2008 and tested for late blight resistance using a detached leaf test. The F3 selection 05109(x)-8W-15 was identified as resistant to late blight and had desired horticultural traits. These selections were in the F2 generation in the greenhouse in the fall of 2008 and tested for late blight resistance using a detached leaf test. The F3 selection 08135(x)-8W-15 was identified as resistant to late blight and had desired horticultural traits. The F4 generation from 08135(x)-8W-15 was grown in the field in 2009 and evaluated for late blight resistance. The F4 line was homozygous-resistant for late blight, and 20 outstanding plants were selected for further evaluation. F5 generation plants were grown in the greenhouse in fall/winter of 2009–10 and evaluated for fruit quality, total soluble solids (TSS), and plant type. NC08135(X)-8W-15-16-64 was selected for its outstanding combination of desirable plant and fruit traits and high TSS content (8.3%) and is being released as NC 6 grape tomato.

When NC 6 grape was evaluated for late blight resistance using a field isolate in the greenhouse in 2012, it was susceptible to the strain of late blight used for inoculation. Testing with molecular markers linked to the Ph-2 and Ph-3 genes for late blight resistance showed that NC 6 grape is homozygous for the Ph-2 gene for resistance but lacks the Ph-3 gene. Additional breeding is underway to combine the Ph-2 and Ph-3 genes in a similar line to improve durability of late blight resistance.

Description

‘Mountain Honey’ has a vigorous, indeterminate growth habit with short internodes conferred by the brachytic (br) gene. Plants are slightly shorter than those of ‘Smarty’. It has a uniform green foliage color that is slightly less dense than that of ‘Smarty’. It has uniform green color of immature fruit (u gene) and averages ≈11 g per fruit. Fruit pedicels are jointed. Ripe fruit are dark red in...
color, long and ovate in shape, and are very sweet with a crisp texture. When averaged over four trials with three replications each at MHCREC in field trials in the summer seasons of 2010–12, ‘Mountain Honey’ was significantly higher than ‘Smarty’ in total yield, marketable yield, and percent marketable yield and had equivalent fruit size to ‘Smarty’ (Table 1). Average TSS (°Brix) of ‘Mountain Honey’ was slightly lower than ‘Smarty’ when six fruit per replication were tested for each of three time periods from early replicated trials in 2010 and 2011. ‘Mountain Honey’ has performed extremely well in numerous observational trials in research stations and in grower fields in western NC and the coastal area of SC. Flavor of ‘Mountain Honey’ has been rated excellent in subjective taste evaluation in research station plots and in grower trial plots by researchers, technicians, and tomato growers.

In growers’ plantings in coastal SC, where TSWV was prevalent, ‘Mountain Honey’ was free of virus symptoms, whereas ‘Smarty’ was severely affected by the disease. In a greenhouse seedling screen in 2012, ‘Mountain Honey’ lacked resistance to late blight as a result of the field isolate used for screening having overcome the Ph-2 gene in heterozygous condition in the hybrid (Table 1). Presence of the I-3 and Sw-5 genes (Panthé and Ibrahim, 2013) in heterozygous condition for resistance to fusarium wilt race 3 and TSWV, respectively, were verified by molecular markers tightly linked to the resistance genes (Fig. 2). A high level of resistance to fusarium wilt race 3 was verified for ‘Mountain Honey’ in a seedling inoculation screen in a growth chamber.

NC 6 grape tomato breeding line has a vigorous plant with a compact indeterminate growth habit with short internodes conditioned by the brachytic (br) gene. Foliage is lighter green than that of other grape tomato lines in the North Carolina tomato breeding program and slightly less dense. Fruit of NC 6 grape tomato average ~16 g. They develop a deep red color, are crisp in texture, and are firm in the fully ripened stage. Immature fruit have a glossy, uniform light green color (u gene). Fruit pedicels are jointed with a tendency for the pedicels to remain attached to the fruit during harvest. The fruit are elongated and ovate in shape and have good resistance to fruit cracking and bursting despite high TSS (°Brix) levels. NC 6 grape is the first known breeding line of grape tomato with the Ph-2 gene for late blight resistance. It may have other resistance genes such as the Ve gene for resistance to verticillium wilt and the I genes for resistance to races 1 of fusarium wilt. They were not found to have I-2 conferring resistance to race 2 of fusarium wilt (data not shown). NC 6 grape was not evaluated in replicated trials for yield or other characteristics because it is intended for use as a parent in producing F1 hybrids only and not as a cultivar for fruit production. However, it has shown heavy fruit set in observational plots with potential for high yield.

Use

‘Mountain Honey’ provides growers in NC and other regions with similar growing conditions a high-yielding, fusarium wilt race 3, late blight, and TSWV-resistant grape tomato cultivar with improved color and fruit size comparable to ‘Smarty’. Because the Ph-2 gene offers protection against limited strains of late blight and is often overcome under severe late blight conditions, the late blight resistance will likely not hold up in seasons with severe late blight pressure. NC 6 grape provides tomato breeders with the Ph-2 gene for late blight resistance, superior fruit quality, high yield potential, and desirable plant traits and should be useful for further breeding and as a parent in other F1 hybrids.

Fig. 1. Pedigree of ‘Mountain Honey’ hybrid grape tomato and its parent, NC 6 grape tomato. NC 4 grape is described elsewhere.