‘Mountain Lion’: A Large-fruited, Extended Shelf-life Hybrid Tomato and Its Parent line, NC 2rinEC

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‘Mountain Lion’ is a large-fruited, fresh-market hybrid tomato (*Solanum lycopersicum* L.) developed by crossing NC 1CS × NC 2rinEC. It is resistant to verticillium wilt (*Verticillium dahliae* Kleb.) (race 1), fusarium wilt [*Fusarium oxysporum* f.sp. *lycopersici* (Sacc.) Snyder. Hans.] (races 1, 2), and *Tomato spotted wilt virus* (TSWV). It combines the *rin* and *crimson* genes, which improve the shelf life and lycopene content of the tomato fruit, respectively.

Origin

‘Mountain Lion’, the F₁ hybrid of NC 1CS × NC 2rinEC (Fig. 1), resulted from a tomato breeding effort to develop a superior large-fruited F₁ hybrid tomato with improved fruit color and increased lycopene content based on the *crimson* gene in homozygous condition and increased shelf life based on the ripening inhibitor gene (*rin*) in heterozygous condition combined with fusarium wilt, verticillium wilt, and TSWV resistances and adapted to vine-ripe production in North Carolina (NC). The resultant hybrid, NC0821, first crossed in the fall of 2007, was tested in replicated and observational trials at the Mountain Horticultural Crops Research Station (MHCRS), Mills River, NC, in 2008–11.

NC 2rinEC has a complex pedigree (Fig. 1). The *rin* gene, which extends shelf life in NC 2rinEC, was originated from selfing an unknown F₁ hybrid fruit purchased from a local supermarket. An F₂ generation selection homozygous for the *rin* gene, designated as Ingles-1, was crossed with NC 93227(x)-37, a firm-fruited line with deep red color that obtained the *crimson* gene from ‘Suncoast’, a release from the University of Florida tomato breeding program. In the F₂ population from this cross, selection was made for the recessive

rin and *crimson* genes combined in homozygous condition. Among the plants in this F₂ population, fruit of some plants had much more intense interior and exterior color than seen in the original *rin* plant obtained from selfing the unknown hybrid and in other known lines with the *rin* gene. This improvement of color in *rin* lines has been designated as “*rin* enhanced color,” abbreviated as *rin*EC. NC 2rinEC is the second enhanced color *rin* line released from the North Carolina State University tomato breeding program. NC 1rinEC, released in 2005, is a parent in the F₁ hybrid ‘Mountain Crest’ (Gardner, 2006). Although ‘Mountain Crest’ produces high yields of good-quality fruit, its fruit size has been smaller than desired for the vine-ripe fresh market. NC 2rinEC has larger fruit size than NC 1rinEC, resulting in larger fruit size in F₁ hybrid combinations where it has been tested.

Description

‘Mountain Lion’ has a vigorous determinate plant (*sp* gene) similar in height to that of

‘Mountain Fresh’ (Gardner, 1999) and ‘Mountain Majesty’ (Panthee and Gardner, 2011) when staked. Foliage provides adequate cover for fruit protection. ‘Mountain Lion’ has homozygous resistance to verticillium wilt (*Ve* gene) caused by *Verticillium dahliae* Kleb., fusarium wilt resistance (*I*, *I*-2 genes) to races 1, 2 caused by *Fusarium oxysporum* f.sp. *lycopersici* (Sacc.) Snyder. and Hans., and heterozygous resistance to TSWV (*Sw-5* gene), which is contributed by NC 1CS (Panthee and Gardner, 2011). It also has the ripening inhibitor (*rin*) gene in heterozygous conditions, which comes from NC 2rinEC, and increases the shelf life of tomato.

Fruit of ‘Mountain Lion’ develop deep red interior color resulting from the *crimson* gene in homozygous condition and are very firm even in the fully ripened stage. Immature fruits have a glossy, uniform green color (*u* gene). Fruit pedicels are jointed. The fruits are deep oblate to flattened globe in shape with generally smooth blossom end scars and have good resistance to fruit cracking and weather check. Flavor of ‘Mountain Lion’ has been rated good in subjective taste evaluation in research station plots and by growers and consumers that have tried fruit produced and marketed from grower trial plantings.

When averaged over eight replicated trials conducted at MHCRS in early and late plantings in the summer seasons of 2008–11, ‘Mountain Lion’ was comparable to ‘Mountain Fresh’ (Gardner, 1999), ‘Mountain Majesty’ (Panthee and Gardner, 2011), and ‘Red Defender’ in total yield, U.S. combination grade yield, percent combination grade fruit, and fruit size (Table 1). A high percentage of the fruit of ‘Mountain Lion’ were in the Jumbo size category (greater than 3.5 in. diameter), which is highly desirable for vine-ripe tomatoes and for which growers are often paid a premium over smaller fruit sizes. Total and marketable yields of

Table 1. Average performance of 'Mountain Lion' as compared with control hybrid tomatoes in replicated trials at MHCRC, Mills River, NC (2008–11).

Cultivar	Non-graded yield (t·ha ⁻¹)	Graded yield (t·ha ⁻¹)	Combination (%)	Fruit wt (g)	Jumbo fruits (%)	Extra-large fruits (%)	Large fruits (%)	Medium fruits (%)
Mountain Fresh	94.5	64.7	68.4	273.6	32.0	43.5	19.4	5.5
Mountain Majesty	94.8	64.0	67.5	294.6	42.2	35.4	15.9	5.3
Red Defender	91.7	70.0	76.3	265.0	24.5	46.1	23.3	4.9
Mountain Lion	91.3	60.4	66.2	276.3	38.4	41.3	20.1	6.4
LSD (0.05)	NS	NS	NS	NS	14.6	NS	NS	NS

Analysis of variance was performed using SAS software 9.3 (SAS Institute Inc., 2011).

LSD = least significant difference; NS = nonsignificant.

'Mountain Lion' were significantly higher than 'Mountain Fresh' in 2008 when there was severe TSWV infection in the field (data not shown).

'Mountain Lion' has the same disease resistances as 'Mountain Majesty' and 'Red Defender'. Like 'Mountain Majesty', it has the *crimson* gene in homozygous condition for improved internal fruit color and increased lycopene content but has increased shelf life compared with 'Mountain Majesty' as a result of having the *rin* gene in heterozygous condition. 'Red Defender' has the *rin* gene in heterozygous condition for increased shelf life but lacks the *crimson* gene present in 'Mountain Lion'.

Plant growth habit of NC 2rinEC is vigorous, determinate with attractive, heavy foliage cover. Fruit are deep oblate to flattened globe in shape, are smooth, and have jointed pedicels. In a replicated field trial at Mills River, NC, in Summer 2004, NC 2rinEC averaged 300 g/fruit, which was significantly greater than the 252-g/fruit mean weight for NC

1rinEC. Immature fruit are uniform light green (*u* gene) and have a glossy finish. Mature fruits are firm and develop some red exterior and interior color as a result of the *crimson* gene combined in the *rin* background with another unidentified gene, which enhances color. Fruits are highly resistant to gray wall and cracking. NC 2 rinEC is resistant to verticillium wilt (*Ve* gene) and races 1 and 2 of fusarium wilt (*I* and *I-2* genes). NC 2rinEC has been tested as a parent in several F₁ hybrid combinations and has shown good combining ability.

Use

'Mountain Lion' provides growers in North Carolina and other states with similar growing conditions, a high-yielding, disease-resistant, fresh-market tomato cultivar with extended shelf life, and desirable fruit quality for vine ripe harvest. The combined resistances to verticillium wilt, fusarium wilt, and TSWV are valuable additions in disease resistance for

growing areas where these diseases are a problem. 'Mountain Lion' should also be of interest to other tomato breeders as a single source of combined resistances to numerous important tomato diseases. NC 2rinEC should prove useful as a parent in additional F₁ hybrids and as a source of improved fruit quality traits in further development of *rin* tomato lines.

Availability

We plan to license 'Mountain Lion' to a private seed company on an exclusive basis for seed production and sales. It is expected that commercial seed should be available in 2015. Distribution of seed of NC 2rinEC to other breeders requires a signed seed transfer agreement, which can be downloaded at the following web site: <<http://www.mountainhort.ncsu.edu/programs/tomato/releases/tomato-seed-transfer-agreement.pdf>>. Small trial samples of 'Mountain Lion' are available from D.R. Panthee (dilip_panthee@ncsu.edu), MHCRC, 455 Research Drive, Mills River, NC 28759.

Literature Cited

- Gardner, R.G. 1999. NC 109 tomato breeding line: 'Mountain Fresh' F-1 hybrid. *HortScience* 34:941–942.
- Gardner, R.G. 2006. 'Mountain Crest' hybrid tomato and its parent, NC 1 rinEC. *HortScience* 41:261–262.
- Panthee, D.R. and R.G. Gardner. 2011. 'Mountain Majesty': A tomato spotted wilt virus-resistant fresh-market hybrid tomato and its parents NC 714 and NC 1CS. *HortScience* 46:1321–1323.
- SAS Institute Inc. 2011. The SAS System, version 9.3 for Windows. SAS Institute, Cary, NC.