Characterization of 4 hybrid rose populations for heat tolerance

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Introduction

Rose (*Rosa* spp.) is an important ornamental crop which is commercially utilized for garden plants, cut flower, and food/medicinal/aroma industrial use. Heat stress is a major abiotic stress in Texas and in the world. It affects the rose appearance by causing increased flower abscission and leaf damage, and decreased flower size. This can reduce its market value. To increase the heat tolerance in rose cultivars, breeding lines derived from wild rose species *Rosa wichurana* were utilized as donor source in trait introgression.

Objective

- Examine the petal number in warm and cool season in the field in four diploid rose populations.

Materials

Four hybrid populations were created by intercrossing heat tolerant (M4-4, J06-20-14-3) and sensitive ('Sweet Chariot', 'Vineyard Song', 'Old Blush', 'Ducher') diploid parents (Fig. 1). All the parents and the progenies were propagated and grown in the field at Texas A&M University.

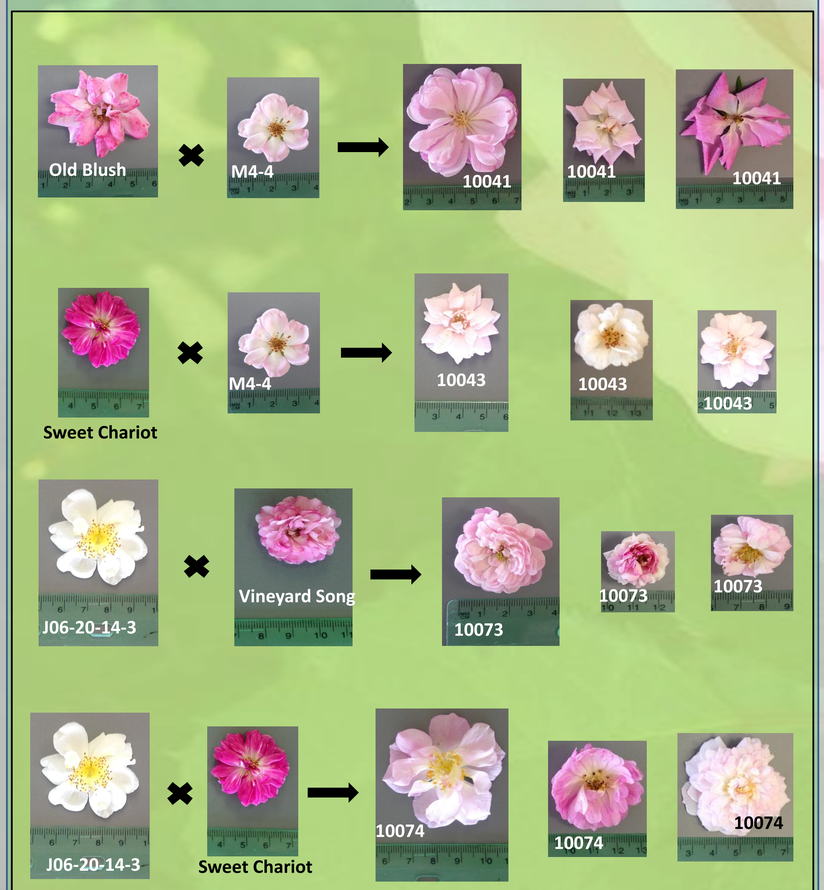

Figure 1. Diploid rose populations showing the parents and a few of the seedlings, that were used in this research.

Method

The petals were counted in late August, 2013, mid-November, 2013, and mid-June, 2014 when the average temperatures were 30.7 °C, 13.6°C, and 28.0 °C respectively (weather collected from Texas Climatologist web site). For each seedling, 3 flowers were collected at the full-bloom stage, dissected and the number of petals and petaloids were counted (Fig. 2). For the cross 10043, the small petals inside the yellow rectangular are petaloids. The number of petals of the flower on 10043 is 42.

Figure 2. Petal counting procedure for rose flowers.

Statistical Analysis

- All statistical analysis was performed using JMP software, Version 11.0 (2013 SAS Institute Inc).

Parental characteristics and two-way ANOVA test with interaction

Table 1			
Parents	Max	Min	Avg
Old Blush	26.5	14.0	24.1
M4-4	7.0	5.0	5.0
J06-20-14-3	16.0	10.0	14.4
Vineyard Song	25.0	17.0	21.0
Sweet Chariot	75.0	33.0	46.7

Table 1. Petal number for the parents of the crosses examined.

Table 2			
	DF	Sum of Squares	significant
Population	3	16569.844	***
Season	1	7031.100	***
Population*Season	3	4150.693	ns

Table 2. ANOVA test of the petal numbers in the warm versus cool season for 4 diploid rose populations.

Given there is a major gene determining whether the flower is single (5-8 petals) or double (> 9 petals) and the number of petals on single flowers change little over the year, the petal number of only the double flowers were considered in this analysis. The number of petals was affected by population and season. There are a greater number of petals per double flower during the cool season (November, 72 petals/flower) as compared to the warm season (June and August, 55 petals per flower). The Old Blush x M4-4 (10041 cross) had less petals per flower (25 petals per flower) than the other 3 populations (53-62 petals per flower).

Interaction Effect

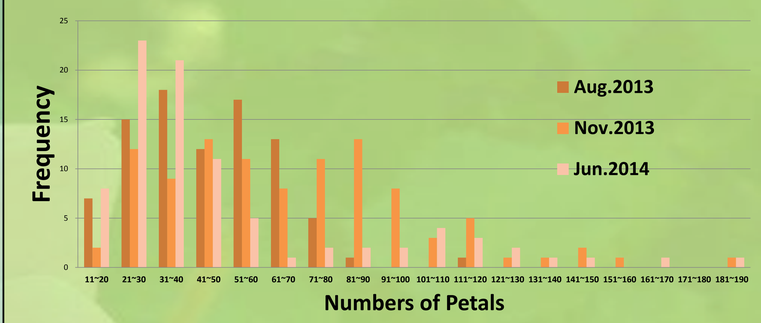

Figure 3. Overall petal distribution for all populations by season.

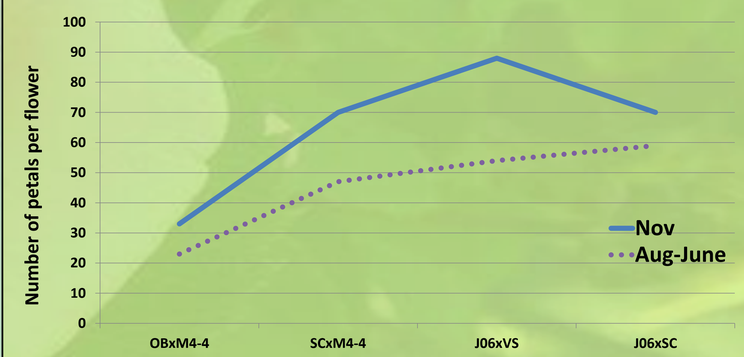

Figure 4. The number of petals shown by season over populations.

As indicated with the mean petal numbers (Figure 3), the frequency of petal numbers larger than 70 mostly comes from the cool season (November) data although there were a few plants from the warm seasons (August and June) which also had greater than 70 petals per flower. This suggests that within these populations there are genotypes that maintain their petal count in spite of heat stress. In general petal counts are reduced by heat stress (Table 2, Figures 2 and 3) for all populations as is the flower size.

Conclusion

- Number of petals is significantly larger during cooler season than in warmer season.
- The 'Old Blush' x M4-4 population had fewer petals than 10073, 10074, and 10043.
- The effect of heat on flower size in rose appears to be reflective of the number of petals that develop in the rose.

Acknowledgement

- Basye Endowment of Rose Genetics
- Texas A&M Department of Horticultural Sciences
- AgriLIFE RESEARCH Texas A&M System