Developing Heat Tolerant Rhododendron Hybrids with Disease and Insect Resistance using *R. hyperythrum*: Part II

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Introduction

In Part 1 (Southerland 2013), I described my experiences raising *Rhododendron hyperythrum* and the hybrids I have developed with it in my hot and humid area of the Piedmont in the state of North Carolina in the American South. In that paper, I detailed not only the species and its hybrids value as landscape plants and their increasing value to those seeking heat tolerance in addition to disease and insect resistance. Having these attributes is important for rhododendron enthusiasts, hybridizers and the casual gardener, as there are presently limited selections available for the more extreme climate areas, as plants there are more susceptible to the problems and diseases such as *Phytophthora* and stem dieback. With most climate experts predicting increasing temperature extremes in the future, this species and its hybrids are likely to be particularly desirable.

In this paper I discuss my hybridizing program in greater length and detail what I have learned and what changes or breeding directions I am presently moving in.

Selecting Parents for Adaption to Hot Environments

Anything that induces stress on the plant must be considered in the selection of parents. In addition to air temperature, sun exposure, length of photoperiod, growing season, moisture and soil temperature are also important. When looking at prospective parents, the phrase describing a plant as "needs good drainage" is practically synonymous with being phytophthora susceptible! It is always better to try to suit the plant to the site conditions than to try to suit the site conditions to the plant. When possible, I have tried to cross other rhododendrons with *R. hyperythrum* as both seed and pollen parent. Reintroducing *R. hyperythrum* into a breeding program as a parent is a good idea, as it

maintains a high nuclear genetic capacity to tolerate heat and resist phytophthora.

R. decorum is another species that processes many good qualities that should complement those of *R. hyperythrum* when used as a parent. The species has vigor and withstands exposure (Cox 2010). It is not fussy with cultural environmental conditions and will tolerate both relatively dry soil and a range of soil pH (Cox 2010). Its hybrids also in general both grow and bud better with good sun exposure (Cox 2010). Given these conditions *R. decorum* generally blooms as a young plant and frequently passes this trait on to its progeny (offspring). This is an important characteristic in hybridizing as it allows the hybridizer to move rapidly from one generation to another toward breeding goals. The greatest negative to using *R. decorum* as a parent is that many forms are only rated as cold hardy to 0° F (-18° C) (Cox 2010). However, *R. hyperythrum* is rated as cold hardy up to -15° F (-26° C) and should add hardiness to its offspring, particularly if used as a seed parent.

('Vulcan' × *R. hyperythrum*) × yellow *R. decorum* yellow form.

'The Honourable Jean Marie de Montegue' × *R. hyperythrum,* selection #1 (Cross #16-2000).

Dr. John Thornton (1989, 1990) reported that in his Franklinton, Louisiana, garden both *R. decorum* and *R. fortunei* do well despite the considerable heat. However, he further added that *R. fortunei* hybrids do not do well and the only satisfactory *R. decorum* hybrid is 'Caroline'. Dr. Krebs (pers. comm.) confirmed that unfortunately neither species had been tested in his phytophthora resistance experiments. I would not expect a great decrease in heat tolerance if either *R. decorum* or *R. fortunei*

(or many of their hybrids) were crossed onto *R. hyperythrum*.

As noted in Part 1 (Southerland 2013), *R. hyperythrum* and its hybrids have many virtues as a landscape plants for warm climates and confer these qualities to their hybrid progeny. However, there are some problems with using it as a parent, particularly with progeny flower color. The first is that typically *R. hyperythrum* flowers start pink in the bud and then fade quickly to white, usually with purple speckling in the dorsal lobe. This fading is frequently passed on to the offspring in primary crosses, but not always. In my opinion, this fading is not as dominant or pronounced as that observed when using *R. degronianum* ssp. *yakushimanum* as a parent; most hybridizers that used *R. degronianum* ssp. *yakushimanum* in primary crosses have experienced this dramatic fading of flower color. Even when the flowers of *R. hyperythrum* fade in color, the colors are clearer and less "muddy" than those of the yakushimanum hybrids that I have grown. Many hybridizers may generalize this fading as common to species of the *Pontica* subsection, although the *R. hyperythrum* affinity to the Ponticum Series has been questioned (Fang et al. 1998). The negative experience of using *R. degronianum* ssp. *yakushimanum* as a parent may have kept many hybridizers from using *R. hyperythrum,* even though it has much else to offer as a parent. More than once I was discouraged or even criticized for using it as a parent.

'The Honourable Jean Marie de Montegue' × *R. hyperythrum,* selection #2 (Cross #16 - 2000).

'The Honourable Jean Marie de Montegue' × *R. hyperythrum,* (Cross #16 - 2000). SS1-09.

The second problem is related to the first in that there are not many available hybrid crosses with *R. hyperythrum* to use in a breeding program. I obtained forms

of *R. hyperythrum* and many of *R. hyperythrum* hybrids from Drs. Means and Thornton for the foundation of my hybridizing program. With these plants and using pollen I obtained from the RSF, I have made crosses with commercial hybrids to produce all desired colors. In the beginning, my hybridizing was simply to obtain red and purple flowers. Parent plants with these colors I could obtain commercially with ease and most that I have used have a reputation of some degree of heat tolerance. Later, other flower colors such as yellow and the "tropical colors" were quickly added to my goals, and this presented its own problems.

('Vulcan' × *R. hyperythrum)* × 'Sedonna, (Cross 5-2005-1).

'Cee Cee' ('Vulcan' × *R. hyperythrum*), (Cross #19 - 1997).

At the start of my breeding program, I used *R. hyperythrum* mainly as a pollen parent. This was because I thought that the seed parent would transmit flower color more reliably, as in general, most hybridizers believe that the seed parent is more dominant in transmitting plant qualities. I have since rethought the value of this strategy, and suggest that using *R. hyperythrum* as a seed parent may have several advantages for both plant traits and physiological characteristics.

My first crosses using forms of *R. hyperythrum* and its hybrids both as a pollen parent and as a seed parent yielded better flower color than expected. For example, *R. hyperythrum* (ARS 233-92) × 'Peter Faulk' resulted in a good light red flower, which faded to rose pink but not to white. I have not only considered the deepness or the saturation of flower color when selecting the perspective parent, but I have also considered to what degree the parent could confer this to its resulting hybrids. Plants with a reputation of

Mike Stillwell with [('Cadis' × 'Autumn Gold') × 'Snow Shimmer'], cross by Mike's father Marshall Stillwell.

producing good offspring, even though in the first generation I might not achieve the desired flower color, were also utilized. 'The Honourable Jean Marie de Montague' and 'Janet Blair' are examples of hybrids with reputations for being good parents, even without taking resulting flower color in consideration. Many of the best red flowered hybrids such as 'Taurus', 'Grace Seabrook' and 'Markeeta's Prize' have 'The Honourable Jean Marie de Montague' as a parent. 'The Honourable Jean Marie de Montague' is also in the parentage of large numbers of the better west coast yellow flowered hybrids, and its offspring frequently also have large flowers. This hybrid's cold hardiness is rated as only -5° F (-21° C), but the cold tolerance of its hybrids in crossings with *R. hyperythrum* would likely be increased. The results of my crosses with 'The Honourable Jean Marie

de Montague' × *R. hyperythrum* are among my favorite plants. The flowers are typically large and the truss full, flower color ranged from near white to almost red with many bicolors, and most have flowers with a prominent dorsal blotch. Plant growth habit ranged from dense to somewhat open, with some "true" dwarfs, the smallest of which measured 2.5 ft (0.76 m) wide and less than 1.0 ft (0.30 m) tall after 12 years, while some sister seedlings grew to 6 ft (1.83 m) high by 6 ft wide (1.83 m) in the same time period. The leaves were generally large and thick and are held two to four years.

'Janet Blair' × *R. hyperythrum,* selection #4 (Cross #84 - 1999).

'Janet Blair' was also used in some primary crosses with *R. hyperythrum* because it is not only a "good doer" in many different climates, but it is "friendly" to the expression of yellow flower color. It is also rated cold hardy to -15° F (-26 °C) so its offspring with *R. hyperythrum* should have good cold tolerance.

'Janet Blair' × *R. hyperythrum* yellow eye, selection #3 (Cross #84 - 1999).

I have made the cross 'Vulcan' × *R. hyperthrum* for red flowers several times with good results. 'Vulcan' is 'Mars' × *R. griersonianum*. The flowers of the cross 'Vulcan' × *R. hyperythrum* vary in color from clear bright pink to various shades of bright red all held in a tight truss. 'Vulcan' with its half *R. griersonianum* parentage also appears to impart *R. griersonianum*'s brightness and color intensity to the flower color of its offspring. 'Vulcan' blooms as a young plant and can pass this early blooming on to its progeny. *R. griersonianum* as a parent also has been useful in imparting its brightness and color intensity to produce not only red, but purple and yellow flowers.

The red species *R. haematodes* and *R. griersonianum* have helped intensify yellow in hybrids containing them, such as 'Fabia, 'Mary Belle', 'May Day' (Knights 2003). Therefore, using these species can be helpful in the pursuit of yellow as well as red flowers.

Over time, the most outstanding and earliest blooming plants of my primary crosses with *R. hyperythrum* became the "workhorses" of my hybridizing program. I then "bridged" from my primarily reliance on the Means and Thornton hybrids to the use of my own hybrids in moving forward on my goals. Two selections of these in particular are presently being used extensively. The first is 'Vulcan' × *R. hyperythrum*, named 'CeeCee', which has bright red flowers, a good habit and beautiful shiny veined leaves that are held for three years. The second is 'Janet Blair' × *R. hyperythrum* ARS 223-92) (selection #1). This is a large flowered bicolor with white, pink and a large dorsal purple blotch, and has a good habit with stout thick stems and large dark green recurved leaves of heavy substance held for up to three years. 'Janet Blair' in the hands of east and west coast hybridizers has proven to be valuable in transmitting yellow flower color to its offspring.

Parent selection in the pursuit of obtaining yellow and similar flower colors has been challenging, as species in these colors and their hybrids are particularly intolerant of warm climates. Whether

('Janet Blair' × *R. hyperythrum*), selection #1 (Cross #84 - 1999).

R. hyperythrum × 'Peter Faulk' (2).

developed on the east or west coast, almost all yellow hybrids are highly susceptible to the root rot pathogen phytophthora. In my experience root rot seems to be particularly an issue of hybrids with *R. wardii* in their parentage. In producing *R. hyperythrum* hybrids that have flowers in cream, yellow and tropical colors, I have had only a few of these hybrids survive long enough to collect pollen and seed. Since there are not many hybrids for breeding with *R. hyperythrum* in these colors that will survive, I have had to largely rely on help from other hybridizers. I have sent pollen from my forms of *R. hyperythrum* and its hybrids to individuals, and they crossed this pollen onto their plants and then sent me the resulting seed. This way, I have made progress in producing hybrids with cream and light yellow flowers and some tropical colored flowers. Some of these tropical colored flowers are similar to 'Percy Wiseman', and some have pronounced calyxes.

A "eureka" moment occurred in 2010 when I had a plant bloom that had true yellow flowers of good depth. The cross was 'Hong Kong' × *R. hyperythrum;* 'Hong Kong' ('Catalgla' × 'Crest') is a David Leach hybrid that has primrose yellow flowers and is hardy to -20° F (-29° C) (Greer 1996). This hybrid was grown from seed that I had obtained through the seed exchange (ARS 2001 #30), and it took ten years to produce one flower truss. The importance of this was huge in that it demonstrated that you can get a good yellow flower color from a primary cross with *R. hyperythrum* as a pollen parent. The good yellow color produced by this cross and the appearance of some lighter yellow flowered colors from some of my other *R. hyperythrum* crosses recently lead me to believe that there should be darker yellows in the garden yet to bloom. Obtaining a true yellow flower with 50% *hyperythrum* in the cross has encouraged me to make more primary crosses with *R. hyperythrum* instead of using *R. hyperythrum* hybrids, as I have previously done.

Another "eureka" moment came when two sister seedlings of yellow *R. decorum* × *R. hyperythrum* bloomed in less than three years from seed. One of the seedlings had light cream flowers and the other white. Both had large flowers and up to eleven in the truss, and were fertile as seed and pollen parents! This was significant for several reasons. First, I now had plants with yellow genes that could potentially greatly reduce the time to blooming from seed. I might thus be able to move more quickly through subsequent generations towards my goals. Second, these plants are being used as both seed and pollen parents and I have a number of crosses growing now. More sister seedlings of this cross have since bloomed, but unfortunately all had white flowers, but all were fertile as both seed and pollen parents. In contrast, many of my other *R. hyperythrum* hybrids as well as those of Drs. Means and Thornton have been pollen sterile and could only be used as seed parents.

In the last several years, another new direction in my quest for tropical and yellow flowers has been the increased use of hybrids containing *R. dichroanthum* and its subspecies. Several *R. dichroanthum* hybrids with 'Autumn Gold' in the parentage have

demonstrated a degree of heat tolerance and have thus been used as parents. These hybrids were developed by local hybridizers Delbert Brim, Marshall Stillwell and Wyatt Lefever. Many of these also have a "yellow form" of *R decorum* in them, as well as 'Janet Blair.' I am presently making use of these hybrids in my breeding program. As noted by Knights (2003a,b), *R. dichroanthum* frequently can pass on its degree of flower color saturation to its hybrid offspring. My use of *R. dichroanthum* hybrids is gradually replacing my use of *R. wardii* hybrids in my effort to produce yellow flowers as I believe this pairing offers more advantages.

The initial blooming of my crosses has persuaded me that careful selection of the parents used can be as important as or even more important than which parent is the seed parent. The fading that can occur when using *R. hyperythrum* as a primary parent can be a problem, but I now believe that it is not an absolute certainly even when using *R. hyperythrum* as a seed parent! The disease resistance and other benefits of having 50 % *R. hyperythrum* in the parentage have already been discussed, and I now feel that the advantages of using *R. hyperythrum* as a seed parent outweigh the negatives because this passes on chloroplasts, mitochondria and other organelles. These intracellular structures are inherited only from the ovum of the seed parent. The chloroplast controls photosynthesis and the mitochondria is involved in the plants' respiration. Both of these structures and their enzyme systems would have been selected for and evolved for optimum heat tolerance. The value of their inclusion by using *R. hyperythrum* as a seed parent would seem obvious.Using *R. hyperythrum* as a seed parent also confers ease of cultivation at all stages of growing the resulting offspring.

Once again I would like to thank the Research Foundation of the American Rhododendron Society and Committee members for helping to fund my hybridizing efforts through ARS grant #132.

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