

***Rhododendron calendulaceum*: Variations in the Wild**

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Abstract: An examination of *R. calendulaceum* in the wild reveals substantial variations in flower color, form, and plant habit. Several favorite populations of this native azalea are discussed, and specific plants considered to be superior forms of the species are described.

1. Introduction

The likelihood of modern plant explorers finding new rhododendron species in the eastern United States is extremely low, despite the 1995 discovery of *Rhododendron eastmanii* by Kron and Creel [6]. But that should not deter exploration, since there is still much work to do in documenting and preserving the best forms of known species. In that realm we have barely started the investigation.



For a period of at least ten years, members of the Species Study Group of the Middle Atlantic Chapter, ARS, have been studying wild populations of rhododendron species native to the eastern United States. We present here some observations of *Rhododendron calendulaceum*, the flame azalea.

2.0 The Flame Azalea, *Rhododendron calendulaceum*

Rhododendron calendulaceum has always been one of the most highly prized of our American native azaleas. Probably the first to appreciate its beauty were the Cherokee Indians who called it the "Sky Paint Flower" because its colorful blooms could mimic a brilliant sunset. William Bartram wrote of the species in his 1791 book Travels:

"The epithet fiery I annex to this most celebrated species of azalea, as being expressive of the appearance of its flowers which are in general the colour of the finest red lead, orange, and bright gold, as well as yellow and cream colour; these various splendid colours are not only on separate plants, but frequently all the varieties and shades are seen in separate branches on the same plants; and the clusters of blossoms cover the shrub in such incredible profusion on the hillsides, that suddenly opening into view from dark shades, we are alarmed with the apprehension of the hill being set on fire. This is certainly the most gay and brilliant flowering shrub yet known..." [1]

R. calendulaceum is an extremely variable species, and as Bartram noted, the variation seen in the wild is quite pronounced. Such wide diversity creates a real challenge in trying to identify unusual forms since every plant is unique. By contrast, some rhododendron species are

much more uniform, such as *R. maximum* where entire hillsides in the wild may appear as though they were planted with a single clone.

Some of the characteristics we admire in the field would be impossible to assess from herbarium specimens. Looking beyond glandular or eglandular hairs, and other features used to distinguish one native azalea species from another [2][4][5], we can focus on more aesthetic qualities. Strolling through wild populations in full bloom, we are able to make qualitative judgments on traits like flower color, flower shape, truss



presentation, plant habit, and foliage quality, just as though we were judging an enormous flower show. In the following sections we relate some of our impressions about this wonderful native azalea species.

3.0 Observations on Species Variation

3.1 Color

The salient feature of *R. calendulaceum* is surely its fiery flower color in shades of yellow, orange, or red. Orange is the most common with pure red being rare, but one should not assume that there are but three color forms of this species. The range is a continuum from light lemon yellow, through deeper butter yellow and rich gold, to innumerable shades and intensities of orange, to orange-red, brick red, and even scarlet. Some plants have flowers of apricot, peach, or salmon. Others may be blends of several colors, possibly brushed with secondary pigments like pink or red. People have reported white forms of *R. calendulaceum*, but not having observed these directly we cannot judge and they may be natural hybrids with other species.



In addition to the corolla color, the blotch of *R. calendulaceum* is a totally independent hue. Some flowers have broad areas of intense gold, orange, or yellow that can completely fill the dorsal petal and even extend into adjacent petals. In some plants, the blotch may be the nearly same color as the corolla and barely noticeable. The pigment in the blotch is usually more intense than the base corolla color, noticeably opaque, and sometimes textured.

Like many native azaleas, the buds of *R. calendulaceum* are often a deeper color than the open flowers, but not always. We have noticed that some flame azaleas have a tendency for the flower color to deepen with age, a transition that can be very startling at times. Flowers on these plants may open clear yellow, but soon deepen to shades of orange or even deep rose red as they complete their color shift. At times, the full range of colors can be present on the same plant, or even within the same flower truss. We suspect the color shift is affected by light since flowers on a plant that open in shade seem to show less color change than those in brighter locations.



The genetics of flower-color expression in *R. calendulaceum* is undoubtedly complex, and surely multiple genes and multiple pigments must control the expression we see. Some of the lighter yellow and orange forms can develop an independent pink flush in the flowers. This can create lovely new shades, but can also make some other flower colors look muddy. Many plants do not show this tendency, and those colors remain pure.

R. calendulaceum is known to be tetraploid, and thus has twice as many chromosomes as our other East Coast native azaleas. Kron discusses research indicating *R. calendulaceum* is an allotetraploid [5], where chromosome doubling was the result of a merger of two distinct species rather than doubling of a single form. Research suggests that *R. calendulaceum* has one set of genes from the orange-red *R. cumberlandense* (*bakeri*) and another set from the rose pink *R. prinophyllum* (*roseum*). Perhaps that pink flush we see in some flame azaleas might be related to the *R. prinophyllum* ancestry, just reminding us its genes are still around.

R. calendulaceum and *R. cumberlandense* are easily confused in the wild since they often grow in the same regions and have a similar color range. *R. cumberlandense* usually blooms later, after the foliage has fully expanded, and the color tends toward the orange-red to red tones rather than the orange to yellow hues that prevail with *R. calendulaceum*. There are many characteristics used to tell these species apart [5], but we have noticed a difference in the clarity of color between the two species. In general, the flower color of *R. cumberlandense* is usually a cleaner hue, rarely muddied by secondary pigments sometimes seen in *R. calendulaceum*. We concur with Skinner's observations in his article "In Search of Native Azaleas". When comparing flower color of *R.*

cumberlandense to the flame azalea, he noted the former had “a color luminosity, in the filtered sunlight, that the other wholly lacks.” [7]

3.2 Flower Size and Shape

Flower size in *R. calendulaceum* is quite variable in the wild. Although the typical corolla diameter is 2 to 2.5 inches [3 – 5 cm], we have found plants with small blossoms less than an inch across [2 cm], to giants with corollas exceeding 3 inches in diameter [7.5 cm]. Of course,



phenotypic expression is related to environment, so it might not be fair to make comparisons without growing plants under identical conditions.

Flower shape can vary significantly from plant to plant. Individual blossoms can be star-shaped with rather narrow petals, to round with broad petals, and everything in between. As the corolla widens into petals beyond the floral tube, that portion can be funnel shaped, flat, or even reflexed. Petal margins can be wavy, ruffled, flat, or frilled. There are rare strap-petal forms, too.

In several locations, we have found double flowered forms of *R. calendulaceum*, but the degree of doubling can vary. Petalodes arise from stamens that have become irregular petal parts, often with anthers still attached. Not all plants with double flowers show the tendency every year, but some do.

3.3 Plant Habit

Plant habit is extremely variable. Some specimens are tall and willowy, especially when growing in light shade or at the boundary of a forest clearing. Those can reach heights of 15 feet [4.5 m], possibly more. On the open balds, the largest plants we see are usually half that height. Plants growing in full sun are typically more robust, putting on 8 to 12 inches of new growth in a season [20 - 30 cm], with the most vigorous growth usually originating from the base of the plant. Perhaps the reason azaleas in open locations do not reach larger sizes is that winter exposure seems to eventually kill some of those older branches. Recurrent loss of woody stems keeps them from getting as tall as plants growing in more sheltered locations.

In addition, we have observed occasional plants that appear very compact to almost dwarf, some growing but an inch or two each year [3.5 to 5 cm]. Of course, we wonder if the dwarf habit would continue to be expressed if that plant were growing in a different environment. We have also seen plants that appear to be prostrate with obvious horizontal branch structure whereas others nearby are noticeably upright.

3.4 Season of Bloom

Season of bloom for *R. calendulaceum* is rarely uniform, even among neighboring plants in the same population. In some locations, we have noticed at least a three-week difference from the time the first plant opens to when the last begins to bloom. Skinner notes a “confusing flowering-time behavior of *R. calendulaceum* from different collection sources.” [7]

The actual date when a specific population will flower depends upon the interaction of multiple factors including weather, altitude, and latitude. Depending upon location and weather conditions, the window of opportunity for finding *R. calendulaceum* in bloom in the wild can extend from April into July. [8]

3.5 Seeds and Seedpods

The seeds of *R. calendulaceum* are not uniform. Some plants have relatively large flat seeds measuring 3/16 inches in length [0.5 cm] and nearly 1/8 inch wide [0.3 cm] with wing-like structures on the sides suggesting an advantage with wind dispersal. In others, seeds can be smaller, 1/8 inch long [0.3 cm], cylindrical to rod shaped with negligible wing structures. Seed color can be light tan to dark brown.

The seeds of some native azaleas like *R. arborescens* are usually much more regular. That species has small dark brown seeds that are nearly round, and less than 1/16 inch in diameter [0.15 cm]. Since *R. arborescens* is usually found along streams and rivers, perhaps that seed shape has an advantage when being dispersed by water.



With *R. calendulaceum*, there is significant variation in the shape of the seedpods, too. Some plants have oval pods measuring 1/2 to 5/8 inches in length [1.3 - 1.6 cm] and only slightly less in width. Other plants have banana shaped seedpods that measure up to an inch long [2.5 cm] and only 1/4 inch wide [0.6 cm].

An interesting note regarding *R. calendulaceum* is the disparity between the vast number of seeds produced each season and yet the relatively small number of young seedlings we see in the wild. In open areas where there are active pollinators like bees and butterflies, almost every flower on every truss produces a seedpod. A large plant can easily have 500 trusses, each of which may have 5 to 9 seedpods, and every one of those is filled with seeds. Since a pod may contain from 100 to 200 seeds, that plant could conceivably produce 250,000 to nearly a million seeds in a single season. Such numbers suggest invasive potential, but apparently seedling survival rates for *R. calendulaceum* are very low.

Fresh *R. calendulaceum* seed germinates readily, and one should expect at least 90% to sprout under controlled conditions. Dry seeds can remain viable for several years, too, even

without refrigeration. Therefore, we are puzzled as to why seedlings in the wild seem so scarce. Perhaps seeds germinate, but are not equipped to survive the early competition and thus, never take hold.

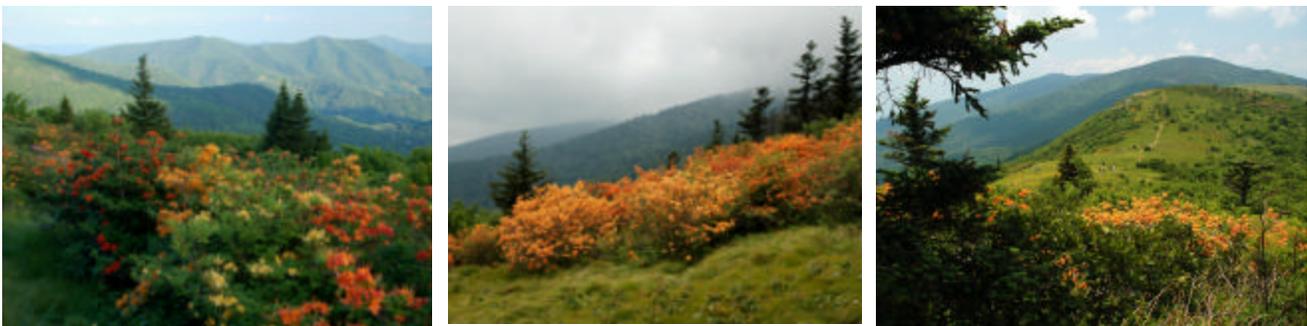
On the other hand, one sees countless seedlings of some other native rhododendrons in the wild. *R. maximum* seedlings germinate with abandon: on fallen trees that serve as nurse logs, on the banks of the streams, along the roadside and trails. On the balds, *R. catawbiense* seedlings can grab a foothold anywhere: in rock crevices, at the base of mature plants, even on recently abandoned trails.

4.0 Favorite Populations in the Wild

R. calendulaceum is found mainly in the mountains and the piedmont of West Virginia, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, and Georgia. It is encountered mostly on the southern and western slopes of the hillsides and mountain ridges of the area in both wooded and open habitats at elevations of 600 to nearly 6000 feet [180 to 1800 m]. The following are some preferred locations where we have conducted our study.

4.1 The Roan Highlands

One of our favorite populations of *R. calendulaceum* is along the Appalachian Trail in the Roan Highlands at the border of North Carolina and Tennessee. A relatively short 30-minute hike from a parking lot at Carver's Gap, just over the 5800-foot crest of Round Bald [1760 m], is an area known as Engine Gap. From there and continuing northeast for several miles is one of the finest and most diverse stands we have seen. The population shows the full color range for the species, and the mountain scenery is truly superb. Peak bloom is usually in mid June.



There are several excellent yellow *R. calendulaceum* selections in this area, including a nice lemon yellow right at Carver's Gap. This isolated plant seems as though someone planted it along the original path of the Appalachian Trail in order to welcome hikers to the Roan Highlands. Recently that section of the trail was rerouted to reduce the rather steep incline hikers experienced ascending Round Bald, and to resolve some erosion problems. The azalea now stands alone in an open field, but unfortunately it has become a favorite food of the local deer. Year-round browsing keeps it from producing many flowers now, or leaves for that matter.



Another superb yellow we admire at Engine Gap is a compact, semi-dwarf plant with dark green foliage that seems to grow but a few inches every year. The lightly ruffled flowers are clear butter yellow with a gold blotch, heavily textured, and measure 1-7/8 inches across [4.7 cm]. This plant is outstanding in every way.

Just beyond Jane Bald is another excellent yellow we call 'Roan Big Bird'. It has clear yellow star-shaped flowers that measure 2 inches across [2.5 cm]. Its petal margins are flat with no ruffling, but its clear yellow color stands out like a beacon when viewed from a significant distance at many vantage points along the trail. Its plant habit is tall and upright.

One of our favorite *R. calendulaceum* specimens is on Jane Bald, a plant we call 'Roan Molten Lava'. The flower color inspired the name, since its ruffled blossoms are an iridescent golden orange, brushed with red, with a broad gold blotch. The flowers are large, 2½ inches in diameter [6.3 cm]. Of course, part of our fascination is due to this plant's extremely photogenic setting, perched at the edge of a steep slope with the contrasting blue green North Carolina mountains in the distance. Even without the view, we feel this plant is a superior form of the species. It has heavily textured, deep green foliage with excellent plant habit, and is also one of the last azaleas to bloom in the Roan Highlands.

There are some good orange reds in the Roan Highlands, some with dainty flowers and others with large blossoms. An excellent large red is located on the side of Big Yellow Mountain. Access is via a spur off the Appalachian Trail called the Overmountain Victory Trail [3], but since this goes through private land, one should get permission before hiking there. Fortunately, the Southern Appalachian Highlands Conservancy recently purchased that mountaintop so it will not be lost to development.

4.2 Hooper Bald

Some of the largest flowered forms of *R. calendulaceum* we have found in the wild are located at Hooper Bald in North Carolina. This 5200-foot bald [1580 m] is easily accessed from a short gravel path leaving from a parking area along the Cherohala Skyway, a relatively new road that runs from North Carolina into Tennessee, south of the Smokies.

Our favorite plant on the bald we call 'Hooper's Copper'. It has huge blossoms that can reach 3¼ inches in diameter [8.2 cm], the largest flowers we have ever seen in this species. The flowers exhibit the color shift previously described, opening yellow but soon changing to a coppery orange. There are actually two different plants entwined in the same location. The larger flowered 'Hooper's Copper' is definitely superior, but a more robust seedling with smaller flowers grows to the foreground and may cause serious competition eventually.





Other plants on Hooper Bald that we admired include 'Hooper Pumpkin'. It has star shaped 3-inch flowers [7.6cm] of Jack-o-lantern orange with a gold blotch. Nearby 'Hooper Valencia' has large flowers of uniform Florida orange color, but it is being rapidly overgrown by an oak sapling that now provides excessive shade. Unfortunately, most of the flame azaleas on Hooper Bald are being threatened by encroaching vegetation.

4.3 Wayah Bald

The wealth of *R. calendulaceum* at Wayah Bald in North Carolina is truly amazing. There are excellent red, orange, yellow, and bicolor specimens everywhere. Due to elevation change, plants at lower levels start blooming in late May but those near the top may not open until late June. Both the Bartram Trail [3] and Appalachian Trail are one as they cross this mountain's 5400-foot summit [1645 m], and *R. calendulaceum* forms the primary sub-canopy shrub on the slopes. We have wondered if this might be the location that inspired William Bartram's words.

There are several double flowered forms of *R. calendulaceum* here, including one that is truly exceptional. The plant seems stable, producing the same excellent flowers every year. The blossoms have no stamens but appear to have two corollas with a total of ten petals, and measure fully two inches across [2.5 cm]. The color is light orange, brushed with red, and the contrasting gold blotch extends to three of the five petals in each whorl.



Wayah Bald is famous for the massive stand of fragrant *R. arborescens* on its summit, but that species can be seen growing side by side with *R. calendulaceum* in many places on the mountain. Even though the two species are intermingled and usually bloom about the same time, we see little evidence of hybridization between the two. We have noticed plants that look like *R. arborescens* but have cream to pale yellow flowers, and others that are white with strong yellow blotches. These may be hybrids but we do not see evidence of an active hybrid swarm with just these two species. On both nearby Copper and Gregory Balds, the hybrid swarms are very robust. The difference seems to be that other species including *R. cumberlandense* and to a lesser extent *R. viscosum* are involved, too.

4.4 The Blue Ridge Parkway and Grassy Ridge Mine Overlook

There are many excellent stands of *R. calendulaceum* along the Blue Ridge Parkway from Roanoke, Virginia, southward. There are scattered plants on the Parkway north of there, but they often appear to be planted. An excellent pale yellow with large, ruffled flowers grows behind a ranger station near the Peaks of Otter. It blooms in mid May, at the same time as nearby specimens of *R. prinophyllum* and *R. periclymenoides*. The flowers have a slight pink tinge.

One of our favorite areas for viewing *R. calendulaceum* is an 80-mile stretch of the Parkway from the entry point near Asheville, North Carolina, southward to Cherokee. There are many overlooks where one can stop and admire the flame azaleas, but we also enjoy investigating less traveled areas on foot.

One spot we have explored is near Grassy Ridge Mine Overlook, elevation 5250 feet [1600 m]. The Mountains-to-Sea Trail [3] exits to the right of the parking lot, heading into woods. It passes through a nice stand of *R. calendulaceum*, and we have investigated that area along the trail up a steep slope to the ridge, and have found many fine selections of the species. When we first observed this population, the flowers seemed predominantly yellow. Since then we realize the full color range is represented including many with strong pink overtones. In 2005, we found two plants with double flowers, both orange in color, but whether they continue to be double will require further observation.

5.0 Conclusions

The members of the Middle Atlantic Chapter, ARS, Species Study Group have only begun our survey of *R. calendulaceum*, but so far we have been amazed at the findings. The variation in the wild is impressive, far more than we previously imagined. We have observed innumerable color forms with complex pigmentation, variations in flower shape and size, plant habits from dwarf to robust, and widely varying blooming times. In an attempt to represent a subset of these diverse characteristics, we could easily fill a huge garden with just *R. calendulaceum* selections.



Standing on the top of 6684-foot Mount Mitchell [2037 m], the highest peak in the eastern United States, we have gazed out on the innumerable mountain ranges that extend in all directions to five different states and wondered what other rare forms of this spectacular species might be hiding in remote locations. Some of those azaleas are cloaked in heavy shade now and may have to wait for decades, perhaps centuries, before the canopy opens up again so they have sufficient light to flower heavily and reveal their full charm.

Our study does raise many questions. Why does *R. calendulaceum* show so much diversity? Is it related to the allotetraploidy of this species, a plant with an abundance of genes competing for expression, or are there other reasons? Will we find character states that exceed the extremes we have already observed? How would the superior plants we have identified perform if grown under different conditions? How might those traits be utilized in hybridizing?

There is ample work to keep modern plant explorers busy for many years. Join us in this effort to document and evaluate not just *R. calendulaceum*, but also other rhododendron species, as they currently exist in the wild. We need to identify the truly superior forms, and then find ways to preserve that biological diversity for the benefit of future generations.

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