American Azaleas, Part II
Misinformation, Unanswered Questions, and Future Research Needs

By Charlie Andrews—Cumming, Georgia

Editor's Note: This is Part II based from the keynote presentation given at the ASA Convention in Little Rock, AR, April 7, 2018. Part I is in the Summer 2018 issue of *The Azalean*, p. 40-45.

Misinformation

Much misinformation on our native azaleas exists in the literature and has since the beginning. Let me give just a few examples:

The Name Azalea

Linnaeus first coined the term *Azalea* as a new species back in 1735 because he thought his new species required a dry, arid habitat.[1]

> *Azalea* from new Latin from ancient Greek (*azaleos*, dry) because it grows in dry soil.
>
> Wiktionary, 3/22/2018

Linnaeus found these plants high in the treeless Lapland Alps in what he said were sandy, rocky, dry places. Since half of the ground was still covered in snow in July with water running in rivulets through the snow, how he determined it was arid is unclear.[2] With his limited exposure to azaleas, Linnaeus did not realize that almost every azalea prefers constantly moist, not wet soil.

Rose Colored *Rhododendron arborescens*

Frederick Pursh introduced *R. arborescens*, perhaps our best white deciduous azalea, as a new species in 1814 and stated he had seen it in the wild and in Bartram's garden outside Philadelphia. He described the species as having rose-colored flowers.[3] [See Photo 1]

This flower color description was repeated by other botanical authors for almost 100 years, including the well-respected John Torrey, Asa Gray, John Claudius Loudon, and Alphonso Wood. Do you think these authors had actually seen a living plant in bloom? It is not a rare species. Both Michauxs, André and son, François André, had earlier described the fragrant white azalea that each found on mountain stream sides, but neither gave it a botanical name.[4]

R. canescens, the Mountain Azalea

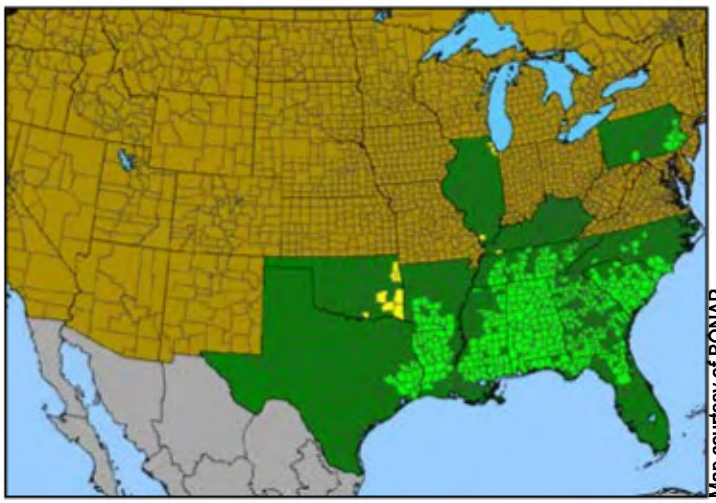
Pursh introduced another point of confusion when he took Michaux's southeastern *R. canescens* and applied it to high elevation plants in the Blue Mountains of Pennsylvania. This confusion lasted for over 100 years.[3] [See Map 1] [5]

He apparently was not aware of the new species *Azalea rosea* named by Loiseleur-Deslongchamps in 1812. Loiseleur's species is now named *R. prinophyllum*. It is generally not heat tolerant and resides mostly in northern climes or high elevations from western Virginia northeastward. There are, as you may know, disjunct populations in Arkansas and southeastern Missouri. It

Photo Charlie Andrews

▲ Photo 1—This is the typical flower of what Frederick Pursh called the rose-colored blossoms of *R. arborescens*. The flowers can occasionally have a yellow throat or blotch, and be flushed with some pink, usually as buds are opening. Pink and light yellow blossoms are found on rare occasions and may be a sign of hybridization.

▼ Map 1—Note the supposed but doubtful distribution of *R. canescens* in Pennsylvania. This southeastern species is sometimes called the mountain azalea possibly because it has been confused with the more northern and higher elevation *R. prinophyllum*.



Map courtesy of BONAP

is because of this confusion between prinophyllum and canescens that you may sometimes see *R. canescens* called the mountain azalea.

Species maps

Species distribution maps often contain errors in both directions, incomplete and false positives. You will find, for example, *R. calendulaceum* throughout Alabama and *R. arborescens* on the Alabama Coast. These errors occur because, with little or no verification, the mappers rely on previous published flora and herbarium specimens.

R. calendulaceum is often reported in the state of New York, but no one can or has pointed to indigenous plants. *Calendulaceum* is rare even in Pennsylvania, the most northern distribution of the species. This repeated piece of misinformation originated from a 1749 Latin description of a yellow azalea on property on the Hudson River. No one else has been able to offer evidence of *calendulaceum* growing as far north as New York. Was a yellow azalea dug elsewhere and brought to the Coldenham estate in New York?[6]

R. canescens, Not in the Piedmont

Clement Bowers, whom I mentioned previously in Part I, was a horticulturist from New York. In his 1936 book and 1960 revision as well as in letters for the 1952 *The Azalea Handbook* and Frederic Lee's 1958 *The Azalea Book*, Bowers argued that *R. canescens* should not be called by the common name Piedmont azalea.

He asserted time and again, in total error I have to say, that *R. canescens* is limited to the Coastal Plain from South Carolina southward and westward.[7] This New Yorker did not have much field experience in the Southeast. If he had, he would have known a very large portion of the biomass of *canescens* resides in Georgia, Alabama, and Tennessee above the Coastal Plain.

I am glad to see that the most used common name today for *R. canescens* is the Piedmont Azalea, which is the most common azalea in the Southeast Piedmont from Texas to North Carolina. To call this species the Florida pinxter as Bowers suggested is quite misleading. Many if not most of the pink azaleas in Florida are pink tetraploids, probably a color form of *R. austrinum*.

When a Hybrid is Not a Hybrid

While the possibility of natural hybrids makes species identification difficult to impossible, it is also true that we have misidentified plants as hybrids when they are just species showing off their variability. Two examples will suffice. Polly Hill introduced the Choptank Hybrids. The original plants came from between Dover, Delaware, and the headwaters of the Choptank River.

She transplanted them in her garden in Wilmington, Delaware, and collected and propagated open pollinated seeds. She showed a particularly attractive form with some pink in the flowers to Henry Skinner, and he thought they were hybrids of *R. atlanticum* crossed with *R. periclymenoides*.

We now know that *atlanticum* is a tetraploid, *periclymenoides* is a diploid, and the offspring are almost always triploid. Recent tests to date have shown Choptank Hybrids to be tetraploids, and we have more field experience to know pink is not uncommon in *atlanticum*.

'Snowbird', a cultivar at the Biltmore Estate was said to be an *atlanticum-canescens* cross, yet tests show it to be tetraploid. Pink does not automatically mean hybridization with *R. periclymenoides*, or with *R. canescens* in the southern portion of the Coastal Plain.

In southern Alabama and into Georgia there are azaleas that were called *R. alabamense* or *alabamense* hybrids. You, of course, know the story of John Thornton, Ron Miller, and others doubting this and finally with enough field work and lab research discovering a new tetraploid species, *R. colemanii*. However, there are still *R. alabamense* labels today at Callaway Gardens in front of *R. colemanii* plants.

Will the Real Tetraploids Please Stand?

I have mentioned ploidy several times. Ploidy has to do with the number of sets of chromosomes a plant or animal has. You have two. Plants can have two, three, four, five, six, or more. Rhododendron chromosomes are very small, so small they can only be seen with an electron microscope. Even then they are extremely difficult to visually count accurately.

The first studies made mistakes. *R. calendulaceum* and *R. canadense* were declared tetraploids, meaning they had twice the normal number of chromosomes. *R. atlanticum* and *R. austrinum* were said to be diploid.

With advanced technology we now know *atlanticum*, *austrinum*, *colemanii*, and *calendulaceum* are tetraploid. *R. canadense* is diploid.

All Flower Buds are Chestnut Brown

In Kron's revision of *Pentanthera* are interesting statements on azalea flower buds. This caught my eye because I have looked at flower buds as one of many characters to help distinguish one species from another. Some are lanceolate; some are quite ovoid. *Vaseyi* flower buds are globose and look like musket balls. Some have pubescence. Some have cilia along the bud scales, and in some cases the cilia are glandular. Some have dark bands

▼ Photo 2—Too many references simply state native azalea flower buds are ovoid. Some, like *R. canescens* are much more ovoid than others.

Photo Charlie Andrews

Photo Charlie Andrews

▲ Photo 3—*R. canescens* is also usually covered with fine soft hairs. *R. periclymenoides* buds are usually not as fat and usually not pubescent.

Photo Bethany Plyler

▲ ▼ Photo 4 & 5—.These distinctive winter flower buds of *R. viscosum* and *R. calendulaceum* (below) are not chestnut brown. Winter buds can aid in species identification.

along the top of the bud scales. [See Photos 2 & 3]

I find a variety of colors, fairly consistent to the species. Yet, in every case, Kron describes the flower buds as "chestnut brown."[8] The only place I have consistently seen chestnut brown native azalea flower buds is on herbarium sheets of dried specimens. [See Photos 4 & 5]

Can't Tell *austrinum* From *canescens*

More examples of misinformation exist. We shall end, however, with this old wives tale. How often have you heard it said when the plant is not in bloom it is almost impossible to distinguish *R. austrinum* from *R. canescens*? In fact, it is simple and easy. New growth on *austrinum* is always glandular. New growth on typical *canescens* is almost always eglandular. I will explain the almost part later.

Photo Charlie Andrews

For Now, We See Through a Glass Darkly: Unanswered Questions

We now move from misinformation to another issue: things we don't know or don't understand about this complex group of plants. In addition to the puzzlement of what should be the best division of our azaleas into species, we still have many other unanswered questions.

► **How did *atlanticum* hide so long?**

Of historic interest is *R. atlanticum*. It grows in the Coastal Plain from southern New Jersey down to Georgia. This is an early blooming, low-growing, highly colonizing, fire-adapting plant that can cover an acre or more with its' runners.

It had to have been stepped on by thousands of settlers and soldiers from Jamestown, Charlestown, and many settlements up the coast and along the King's Highway. Yet, it was not recognized as a species until 1917, probably being confused with the later-blooming *R. viscosum*.

► **Why does *R. occidentale* fail on the East Coast?**

The only native azalea on the West Coast is *R. occidentale*. Though the typical form is a white flower with a yellow blotch, there are very attractive multi-colored forms. We have never been able to successfully grow this species in the east. The reason remains elusive. Climate? In the west, it grows on the coast and as high as 9,000 feet at Donner Pass. In the east, we fail north and south. Soil? What special conditions might it need? Great Britain seems to succeed with this species.

► **Where are *R. austrinum* and *R. atlanticum* triploid hybrids?**

We know *calendulaceum*, *austrinum*, and *atlanticum* are tetraploid, and when they pollinate a diploid azalea the result is almost always a triploid. Many natural triploid hybrids with *calendulaceum* have been found. Almost no triploids in areas of *austrinum* and *atlanticum* have been discovered. Is this because of a difference

in the tetraploids? Is it because we simply have yet to recognize a possible natural hybrid and send a sample for testing?

► **Yellow River vs. Escambia River *R. austrinum***

In the lower section of the Yellow River in Florida, the tetraploids are all pink. Going up river, a transition eventually occurs with a mixed area of pink, white, and yellow. Farther up only yellow *austrinum* are found. The Escambia River is not far away, but the situation is quite different. Here, *austrinum* occurs in mixed colors all along the river: yellow, pink, white, and multicolored. Change in acidity does not seem to explain this difference.

► **Is *R. canadense* really an azalea (or is it even a *Rhododendron*)?**

We have always known the delightful Rhodora, popularized by Emerson in his poem, was unique. Alarm bells went off at the 2013 joint ASA/ARS convention in Asheville when Jason Lattier, one of Dr. Tom Ranney's graduate students presented results showing *R. canadense* appears to have a base chromosome number of 12, not the uniform base number of 13. The sampling covered multiple locations across the geographic distribution. If this holds true, it begs the question: Should *canadense* be considered an azalea? Is it even a *Rhododendron*?

► **Should *vaseyi* be considered one of our azaleas?**

R. vaseyi is another plant that we know is different. In the 2005 revision of *Rhododendron*, Loretta Goetsch et al. moved *R. vaseyi* out of *Pentanthera*. In their analysis, *vaseyi* was more closely related to plants formerly in *Menziesia* than our other American azaleas.[9] If true, this places some doubt on our even calling *vaseyi* an azalea.

► **How does color relate to species?**

When is a blotch a sign of hybridization or introgression? Is the pink tetraploid in north Georgia *R. calendulaceum*? Is the pink tetraploid in the Florida Panhandle *R. austrinum*?

Recent Research/Discoveries

Since we have known about our native azaleas for over 300 years, we may tend to think we know them well. While questions remain as we still see through a glass darkly, in fact, we are learning more every day.

New Species

R. eastmanii was declared a new species in 1999. For years it was said to be a disjunct group of *R. alabamense*. The aforementioned *R. colemanii* sat quietly in the Red Hills section of Alabama until someone finally realized *R. alabamense* grows in different habitats. It became a new species in 2008.

Pink Tetraploids = *R. austrinum*?

In Florida, John Kunkle Small, Henry Skinner, and all others have assumed any Deep South pink azalea was *R.*

Notes on Introgression

Introgression is the infiltration of the genes of one species into the gene pool of another, usually through backcrossing of an interspecific hybrid with one of its parents.

Upward introgression: Introgression from diploids into species of higher ploidy, commonly thought of from diploids to tetraploids (via fertile triploids).

Photo Charles Andrews

▲ Photo 6—Above is an example of possible upward introgression, from diploid to tetraploid. DNA analysis may be able to verify the conjecture.

Downward introgression: Introgression from polyploids into species of lower ploidy, commonly thought of from tetraploids to diploids (via fertile triploids).

Photo Charles Andrews

▲ Photo 7—Above is a Cherokee County Georgia diploid (repeatedly tested) that has morphological features of *R. calendulaceum*, a tetraploid: large flowers, wide petals, flat open face, orange blotch. There were many triploids in the immediate area, a sign of *R. calendulaceum* x *R. canescens* hybridization, thus suggesting possible downward introgression from tetraploid to diploid.

canescens. Detailed field examination recently has revealed them to be wrong. Ron Miller discovered the pink tetraploids that in every other aspect are identical to *R. austrinum*.

Can1 and Can2, Two Southern Pink Diploids

Even more recently as Ron Miller explores the rivers, fields, and woods with an eagle eye, he has discovered that there are two types of southern pink diploids. We call these Can1 and Can2.

Can1: This is the typical *R. canescens*. It has pink to white flowers with glandular hairs on the flower tubes and often twisted, revolute petals. New growth is eglandular, distinct from *R. austrinum*.

Can 2: Then in eastern Texas, Ron discovered pink azaleas with glandular new growth. To his surprise, ploidy tests showed these plants to be diploid. Looking much like *canescens*, these Can2 plants reside in a moister habitat, tend to have broader petals, and are quite stoloniferous. Can2 plants are predominant to the west in eastern Texas and northern Louisiana. They occur only rarely eastward where Can1 dominates. Should Can2 be considered a new species?

Ploidy Research

Recent ploidy research has opened our eyes to a better understanding of possible species and hybrid relationships. It was the 2007 research of Jeff Jones, another of Dr. Tom Ranney's graduate students, that revealed *atlanticum*, *austrinum*, and *calendulaceum* are tetraploids with twice the usual number of chromosomes.[10] Soon, the aforementioned *colemanii* was added to the list.

John and Sally Perkins joined with a team at the University of Coimbra in Portugal in an ongoing multi-year study of *Rhododendron* ploidy. By testing hundreds of cultivars and wild plants, and the Perkinses making crosses with parents of known ploidy, they have come up with some general ploidy rules. Their ploidy research is a presentation in itself, and I am anxiously awaiting their publications. Here are just a few derived observational rules:

- diploid x diploid = usually diploid
- tetraploid x tetraploid = usually tetraploid
- diploid x tetraploid = usually sterile triploid
- tetraploid x diploid = usually failure
- fertile triploids can occur but are rare
- triploids can produce diploids, triploids, tetraploids, pentaploids
- In diploid x tetraploid F_1's, offspring tend to look more like the tetraploid parent

New Research Needed

That was an overview of recent research. So, what is needed to better understand these wonderful plants?

Field research

We need more field research. We need boots on the ground, studying populations in *situ*. Too much of the previous research results was based on herbarium specimens that do not and cannot accurately represent the entire populations of live plants.

Applied Multimedia Technology

We need a modern replacement for herbarium specimens as the primary source of data. Using dried specimens was advanced technology in the 16th century. They show only a snapshot or two in the annual cycle of the plant. Much is lost in the dried evidence. A specimen may not represent the typical population or the peak bloom and thus may be misleading. With such scant evidence, the plant may be misidentified by the author and those who examine it.

I am not suggesting we eliminate herbarium specimens but supplement them with 21st century multimedia technology with databases of morphological characters and habitat, GPS records, and digital habit, landscape, and both macro-lens and microscopic images.

More Ploidy Testing

We need much more ploidy testing, especially on wild plants, to better understand what is happening between our tetraploids and diploids. We need to find more fertile triploids and analyze the population around them to better understand how these triploids naturally occurred. We need to find further evidence of downward introgression and upward introgression from tetraploid to diploid and vice versa. (See sidebar examples.)

Hybridization Research

We need more hybridization research. Systematic hybridization by humans can help us better understand what has been and is going on in nature.

Extensive DNA testing

Finally, and perhaps most importantly, we need extensive DNA research on our native azaleas. Such studies will require careful controls to assure large quantities of samples, known provenance of the samples, known character differences among and within populations, and geographically diverse populations. It is my hope that from these studies we can learn how related our 17 species really are.

Our ASA Research Fund can help support such studies. Your contribution can help. See information on the ASA website: https://www.azaleas.org/research/arf-mission/

I hope you now see our native azaleas are indeed a very complex group. We still have much to learn about them. Thank you for indulging me with my love of these beautiful azaleas.

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Charles Andrews of Cumming, Georgia, is vice president of the ASA, a member of the Vaseyi Chapter of the ASA, and a former member of the Oconee Chapter. He is a plant lover in general, but his heart is with azaleas. He enjoys writing and speaking on azalea topics, contributes articles to *The Azalean*, and serves on the journal's Editorial Advisory Board.

He is also immediate past president of the Azalea Chapter of the ARS. For over 35 years, Charles has been studying American deciduous azaleas. He and like-minded "azaleaphiles" spend many hours hiking in the field each year trying to better understand the distribution, habitat, characteristics, and dynamics of this amazing plant complex, primarily found in eastern North America.

He believes these plants deserve more scientific study and horticultural emphasis. Charles is working to make accurate information on the history, identification, distribution, and culture of native azaleas more available.

Deadlines for input for *The Azalean*

April 1—
Summer 2018 Issue

July 1—
Fall 2018 Issue

October 15—Winter 2018 Issue

December 1—Spring 2019 Issue