CHINQUAPIN
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Southern Appalachian Botanical Society

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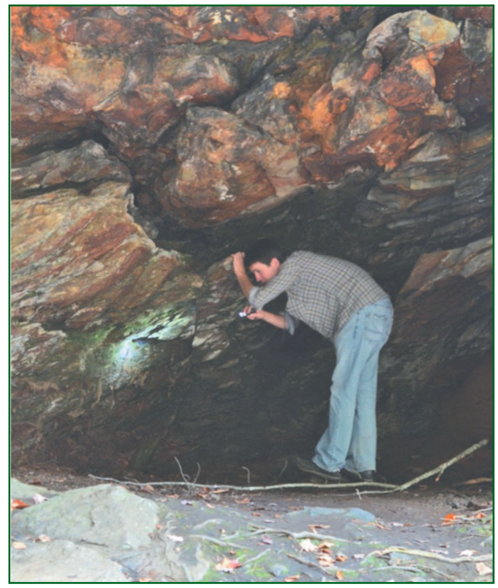
EARL CORE STUDENT REPORT

Where Have All the Sporophytes Gone?

By Gerald Pinson

Scattered throughout the Appalachian Mountains are a series of sandstone bluffs punctuated by large, recessed caverns known as rock shelters, which were carved from mountainsides by running water. Near the backs of these shelters, light is scarce, and the air is insulated from the surrounding environment by several thousand tons of overhanging rock. At first glance, it might appear that these shady grottoes are devoid of life, but a closer inspection (often requiring a flashlight) reveals abundant growth of what appears to be moss. The occurrence and identity of these plants mystified researchers for several decades until, beginning in 1936, they were determined to be the prothalli of fern gametophytes. Since then, researchers have determined that there are a total of three fern species growing in the Appalachians that have no known sporophyte (the charismatic, photosynthetic, diploid stage of the plant life cycle) anywhere in the world. The species are the filmy fern *Crepidomanes intricatum* (the closest relative of which grows in Asia), the rare filmy fern *Hymenophyllum tayloriae*, and perhaps the most well-known, the Appalachian gametophyte, *Vittaria appalachiana*, all of which are endemic to the Appalachian Mountains. What is even more strange is that all three species belong to tropical fern families that grow abundantly in Central and South America and the paleotropics. How the gametophytes of these species ended up in temperate North America, bereft of their sporophyte counterparts, is a mystery.

Without the diploid stage of the life cycle, and restricted to small microhabitats in the rock shelters of the Appalachians, it might seem that these gametophytes are an evolutionary dead end, a mere footnote in the long natural history of ferns. But these species are actually part of a much larger trend in fern evolution. While most ferns have small, heart-shaped gametophytes that are generally short-lived (<1 year), the independent gametophytes of the Appalachians have a branched and dissected morphology and are capable of sustained, perennial vegetative growth and asexual reproduction. This dissected morphology has evolved independently in ferns at least five separate times, and is usually associated with a switch from a terrestrial (growing on soil) to an epiphytic (growing on other plants, i.e. trees) growth habit, and it's been hypothesized that the long prothallial filaments and strands they produce may help gametophytes of epiphytic ferns to more effectively compete in crowded tropical canopies.



While ferns are generally considered to be an old lineage, most

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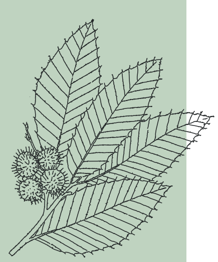

From The Editor's Desk:

Joe Pollard, Newsletter Editor

This edition of Chinquapin kicks off with a report from Jerald Pinson, a recipient of the Earl Core student research grant. It's always exciting to hear about the progress our student members are making; I firmly believe that support for botany students – however modest – is one of the most important things our society provides. Lytton Musselman contributes the second in his new series on edible wild plants, and Alan Weakley wraps up his 2-part article on the perils of inferring the native range of a species based on its botanical name. George Ellison's "Botanical Excursions" feature concentrates on one of my favorite trees, Magnolia fraseri. This article is excerpted from George's upcoming book, "Literary Excursions in the Southern Highlands", due to be published this fall by The History Press. Look for more information about it in a future edition of Chinquapin.

I have long enjoyed the unique beauty of Fraser magnolia – the large leaves with their unusual shape, and the lovely, fragrant flowers. But what I find especially fascinating is that it is possible to visit the very spot upon which William Bartram eloquently described that unique beauty during his excursions through our region in 1775. That area is in Rabun County, Georgia, at the base of Martin Creek Falls, about a 1.8 mile hike north of Warwoman Dell Picnic Area on the Bartram Trail. The hike is described in detail in the book "Exploring Southern Appalachian Forests" by SABS members Steph Jeffries and Tom Wentworth, published in 2014 by the University of North Carolina Press. It is listed as hike number 5 in the book, and the account includes extensive passages from Bartram's "Travels" in which he describes the beauty of the area and of this newly discovered species of Magnolia. I know of few examples in which "history" and "natural history" coalesce to this degree.

SABS Welcomes Our New Members

Michael Crosby
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Nicholas Flanders
Katherine Goodrich
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Gary Garrett
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Grace L. McCartha
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Gerald Schneider
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Varma-Rose J. Williams

Bereavement Notice

Dr. John M. Herr

It is with great sadness that we report the passing of Dr. John M. Herr on June 19, 2016. Dr. Herr was Distinguished Professor Emeritus in the Department of Biology at the University of South Carolina. He was president of SABS in 1992-1993 during which time he oversaw the change of our organizational name from club to society and worked for revision of the constitution. He was the recipient of our Elizabeth Ann Bartholomew Award in 1996. John also devoted great energy to the Association of Southeastern Biologists, holding almost all of its senior leadership offices including president, and receiving every important award that ASB bestows, including the inaugural ASB Lifetime Achievement Award, which now bears his name. A full tribute is planned for publication in Castanea. An obituary from "The State" newspaper is available at: http://www.legacy.com

"*Caroliniana*"? – not so fast…

By Alan Weakley, University of North Carolina Herbarium (NCU), North Carolina Botanical Garden

[Part 1 of this essay appeared in Chinquapin 24(1), spring 2016.]

We now recognize that a major part of European exploration and colonization of the New World was, in modern terms, "bioprospecting": "the systematic search for and development of new sources of chemical compounds, genes, micro-organisms, macro-organisms, and other valuable products from nature." Soon after the European "discovery" of the Americas, medicinal, culinary, fiber, and horticultural plants were being brought back to Europe: potatoes, tomatoes, corn, and beans as food, sassafras as a cure for syphilis, lignumvitae as medicine, tobacco as a drug, white pines as masts for the British Navy. This suggests that much was learned and recorded about the flora of North America in the 1500s, 1600s, and 1700s, and while it is true that many plants were discovered and catalogued, knowledge of the full flora and its distribution was poor and fragmentary. Hampering our understanding was the absence of a consistent system for naming and categorizing the discoveries, Linnaean binomial nomenclature beginning only in 1753. From North America, we have very few specimens collected before 1800 of even common plants. Detailed accounts of travelers and botanists are also few and the identities of plants described often uncertain.

What was happening (non-botanically! – is there such a thing?) in the Americas in the more than three centuries from 1492 to 1800? A lot! The human population grew back to about its pre-Columbus number of 30 million, and European settlements in North America generated ever-increasing trade with Europe, the West Indies, Africa, and Central and South America (to get a feel for this shipping activity, see www.theguardian.com/news/datablog/2012/apr/13/shipping-routes-history-map). Ships carried some plants deliberately, but many more by happenstance, as seeds, spores, and other propagules mixed in with ballast stones and soil, in food stores, attached to clothes, and in the guts and hair of people and domestic animals. Plants were moving to and from North America and from place to place in North America for hundreds of years before we have detailed knowledge of their whereabouts. So, when a botanist encountered a plant in a particular part of North America in 1800, how do we know if it grew there in 1500?

The answer is we do our best with deductions and circumstantial evidence. In Part 1 of this article, I mentioned *Commelina caroliniana*, first described by Thomas Walter in 1788 in his Flora Caroliniana. Until recent decades, this was always assumed to be a southeastern United States native. But Robert Faden concluded (in a 1989 paper published in Taxon 38: 43-53) that it had been introduced from southern Asia. The identical species was described in 1874 in India, and named *Commelina hasskarlii* C.B. Clarke; by the nomenclatural rule of priority, it must take the older name, *C. caroliniana* Walter (1788). But where was it native? Its scattered distribution in the southeastern United States and its nearly universal occurrence in weedy, disturbed, or agricultural situations provides a hint. Faden writes:

> "*Commelina caroliniana* was introduced into the United States at least two hundred years ago. The place and means of such old introductions are usually impossible to pinpoint but, in this case, there are a few clues. First, *C. caroliniana* must have come from the Indian subcontinent. Second, the earliest known American collections … came from South Carolina. Third, although *C. caroliniana* has been collected in a variety of habitats, it is frequently found as a weed in crops, especially rice. Fourth, following an earlier introduction from Madgascar, rice was introduced into South Carolina from India in 1696… Fifth, Thomas Walter's goods and chattels, as inventoried after his death, included more than 2700 barrels of rice, indicating that he must have grown the crop… By weaving together the above facts we can produce the following plausible scenario. *Commelina caroliniana*, sometimes a weed in rice in its native haunts…, likely was introduced into the United States in South Carolina via the port of Charleston with rice seed from India in the late seventeenth century. It was possibly a weed in rice when it was collected by Thomas Walter for the first time in the United States on or in the vicinity of his estate in Berkeley County, South Carolina along the Santee River about 80 km north of Charleston."

Another interesting '*caroliniana*' example is *Modiola caroliniana*, the Carolina Bristle-mallow. In the southeastern United States it is frequently seen in landscaping around buildings, lawns, and disturbed urban areas. It had been reported before its 1753 description by Linnaeus ("Habitat in Carolina"). It is now widely distributed in the southeastern United States, Arizona, California, Oregon, Mexico, Central America, South America, and Hawaii. Its early collection in the southeastern United States has led to an assumption that it was native in that region, but Steven R. Hill (in Flora of North America, volume 6) concludes based on its relationships and habitats that it "is undoubtedly adventive over most of its range and possibly native only in northern Argentina and the Paraná basin of South America." It could easily have been transported from the busy 16^{th} and 17^{th} century ports along the east coast of South America (such as São Paolo, Brazil, founded 1554) to Spanish Florida (with ports such as Saint Augustine, founded 1565), from which it spread by shipping and overland.

As implied by Faden's 10 page scientific paper elucidating the story of *Commelina caroliniana*, figuring out these histories is not simple. We increasingly have molecular tools to help us determine the degree of relationship and the likely time since divergence between two populations (200 years? 2000? 200,000?) but it will still take time and effort to investigate the movements of plants between and within continents in the European colonial era, let alone what plants moved around in the Americas because of deliberate or accidental transport associated with native American agriculture and trade. The tobacco, squash, beans and corn grown in what is now the southeastern United States at the time of European contact were pre-colonial agricultural imports from Mexico; what weeds came with them? Perhaps *Modiola caroliniana* did not come on Spanish ships from what is now Uruguay to what is now Florida – it may have traveled earlier by land trade of native Americans.

A few decades ago, we might not have even asked the question or if we did, might have shrugged and said "we'll never know"; now we have the tools to find out. In an era of climate change and biodiversity loss, understanding past plant migrations (human-caused and not) can help us plan for the future.

BOTANICAL EXCURSIONS

Magnolia fraseri: Slow Dancing With the Beetles

By George Ellison (www.georgeellison.com)
Artwork by Elizabeth Ellison (www.elizabethellisongallery.com)

In the coves of the Southern Appalachians, cooled by the breezes set astir by ever-falling water…this lovely tree is most at home, its flowers shining forth serenely as water-lilies floating in the forest green.
–Donald Culross Peattie, *A Natural History of Trees* (1950)

One of the more prominent of the literary naturalists in this country during the first half of the twentieth century, Donald Culross Peattie—who lived in Tryon, North Carolina, for extended periods—was a gifted observer of trees. Those familiar with Fraser magnolia (*Magnolia fraseri*) will recognize the uncanny accuracy in his comparison of its flowers "shining forth serenely…in the forest green" with water lilies. Symmetrical clusters of Fraser magnolia leaves and flowers held aloft on their slender, almost invisible branches in the dim light of a mountain cove do seem to hang suspended, as if afloat in water at twilight. At such moments, there is something spectral about this ancient plant.

Unlike any other magnolia species, Fraser magnolia (also known as mountain magnolia) is largely, but not exclusively, restricted in its native range to nine states from eastern West Virginia to north Georgia in the Southern Appalachians. The magnolias—of which there are more than two hundred species worldwide—were named for the French botanist Pierre Magnol in the eighteenth century.

Arthur Stupka, the first park service naturalist in the eastern United States at Acadia National Park in Maine and, subsequently, the first naturalist in the Great Smoky Mountains National Park (1935-1963), was one of my mentors after he retired as park biologist in 1967 and spent his summers at the Hemlock Inn in Bryson City, leading field trips up until his death in 1999. Among the 137 species of trees in the park to choose from, including some that are naturalized, Fraser magnolia was one of his favorites. His meticulous field notes, published as *Trees, Shrubs and Woody Vines of the Great Smoky Mountains National Park* (1963), contained the following observations:

[Fraser magnolia is] common below 5,000 feet [to the lowest elevations]…with the large creamy-white flowers ordinarily appearing in late April or early May [although] these have been noted as early as the end of March (1938, 1945). Occasionally flowers may remain on the trees into June (June 13) at the higher elevations. The fruits begin to turn color in July and are bright red by late July and through August . . . Within the park there are a number of specimens of 8 ft. in circumference and at least 80 ft. in height . . . This tree is readily identified by its smooth light gray bark, its large eared leaves arranged in superficial whorls, and its large cream-colored flowers . . . Quite frequently, several stems or sprouts arise from the base of the tree.

According to the National Big Tree Program sponsored by American Forests, the current (2016) national champion Fraser magnolia is located in Carroll County, Virginia. It weighs in at 129 inches (girth), 73 feet (height) and 61 feet (crown spread). By "superficial whorls," Arthur was referencing the fact that the leaves are clustered so closely at the tips of the branches they appear to be whorled. Each leaf is about 8 to 10 inches long and 4 to 6 inches wide with lobes or ears at the base.

In his compendium of species accounts titled *Magnolias* (1978), Neil G. Tresender described the upper sides of the leaves as having "an almost iridescent sea-green sheen" and quoted the peculiar analogy by Phillip J. Savage Jr. from the June 1969 issue of the Newsletter of the American Magnolia Society that the surfaces of new growth on the young leaves of *Magnolia fraseri* "refract light in an unusual way, something like gasoline looks floating on water. It isn't a gloss, it's a slight iridescence, and gives the harpoon-shaped leaves a look of real distinction."

In *Wildflowers & Plant Communities of the Southern Appalachians and Piedmont* (2011), biologist Timothy P. Spira provided a concise description of the floral arrangement:

The large showy flowers are typical of magnolias, each with an elongated axis surrounded by a basal cluster of spirally arranged stamens terminated by spirally arranged pistils, each pistil bearing a single recurved stigma lobe at it's tip. Because the stigma lobes are receptive before the anthers open and release pollen, cross-fertilization is promoted.

Sometimes referred to as "living fossils," magnolias are among the oldest flowering plants on earth, dating back 100 million or more years to a time when there were no bees. Their primitive bowl-like floral design that catered to beetles preceded more sophisticated pollination strategies by eons. Harold Moldenke, a some-

Magnolia continued on Page 13

Magnolia continued from Page 12

what neglected yet keen-eyed observer of North American flora, noted in *American Wild Flowers* (1939):

One of the most pronounced tendencies in the evolution of the higher plants is away from the large solitary flowers and toward ever smaller flowers aggregated in ever denser clusters. From the large blossoms of a magnolia or a buttercup evolution has proceeded through the spireas, hollies and horse chestnuts, to plants like the ginseng and flowering dogwood, which have the actual flowers concentrated in small clusters, called umbels, and then on to such plants as the carrots and parsnips, which have these simple umbels further aggregated into compound umbels, which produce quite as much display of color as the solitary blossoms of their remote ancestors.

In addition to Fraser magnolia, there are three other deciduous species of magnolia found in the Southern Appalachians: big-leaf magnolia (*M. macrophylla*), cucumber tree (*M. acuminata*) and umbrella-leaf magnolia (*M. tripetala*). Any evergreen magnolias reported from the mountains are probably naturalized. The very common tree known as tulip or yellow poplar (*Liriodendron tulipifera*) is a member of the magnolia family but is classified in a separate genus.

Named for the Scottish plant hunter John Fraser, the Fraser magnolia was initially encountered in the wild by American plant hunter William Bartram in May 1775 in the northwest corner of South Carolina and across the Chattooga River in the northeast corner of Georgia. Obviously excited, he described the event in some detail in his now famous *Travels in North and South Carolina* (1791):

The crooked wreathing branches arising and subdividing from the main stem . . . turn upwards, producing a very large . . . perfectly white, double or polypetalous flower, which is of a most fragrant scent; this fine flower fits in the center of a radius of very large leaves, which are of a singular figure [as they] form an expansive umbrella superbly crowned or crested with the fragrant flower, representing a white plume; the blossom is succeeded by a very large crimson cone . . . containing a great number of scarlet berries, which when ripe, spring from their cells and are for a time suspended by a white silky web or thread.

Beetles can smell better than they see. Attracted by the pleasant fruity odor exuded by Fraser magnolia blossoms, they crawl into the bowl and rummage around searching for food and shelter. The showy petal-like structures that enclose the bowl are undifferentiated sepals and petals called tepals. These have the slightly luminescent quality Peattie noted that would, when combined with the iridescence attributed to the leaves, help attract and guide the optically challenged beetles in the shadowy recesses within which the tree is often found.

In his *Highlands Botanical Garden: A Naturalist's Guide* (2012), entomologist James T. Costa, director of the Highlands Biological Station, called attention to the fact that "this flower type is called 'cantharophilous'—beetle-loving." When asked what the study of nature told him about God, biologist J.B.S Haldane replied, no doubt with a twinkle in his eye, that "the Creator apparently had an inordinate fondness for beetles."

Indeed, 450,000 species of beetles are currently known worldwide. Fossil evidence indicates they were on the scene when angiosperms (flowering plants) first appeared 150 or so million years ago—that is, by some estimates, 30 to 50 million years before bees emerged.

(Jill R. Barbour, a forester and germination specialist at the USDA Forest Service's Tree Seed Laboratory in Dry Branch, Georgia, prepared a life history of Fraser magnolia for the *Woody Plant Seed Manual* that has been relied upon to a great extent, in the following observations on pollination and seed dispersal strategies.)

Not a few of the modern-day descendants of those ancient beetles—*mostly* members of the Rolling Water (Mordellidae) and Sap-Feeding (Nitidulidae) families—have retained their "inordinate fondness" for the modern-day descendants of ancient angiosperms like the magnolias. The beetles aren't seeking nectar. They're after pollen as a food source, and their tactics—sometimes referred to as the "mess and soil" strategy—are not sophisticated. After entering a flower, they wallow around in the pollen. Coated with it when they visit another flower, they provide an excellent opportunity for cross-fertilization to take place.

The large cone-like fruit (follicetum) consists, in part, of numerous small pocket-like structures (follicles) that contain one or two developing seeds each. A single follicetum may produce as many as sixty scarlet seeds. The "white silky web or thread" Bartram mentioned are called "funicular outgrowths" in some botanical manuals. Funicular means anything operated with strands. Various vascular floras describe the attachments as "filamentose hairs," "extensible threads" or "funicular strands," while a citation in the *Oxford English Dictionary* likens them to "umbilical cords."

Some of the seeds remain suspended for days before falling to the ground. Why? The tree may be primitive in many regards, but it has adapted so as to cater to animal dispersers capable of distributing seeds at a considerable distance from overbearing parents. Birds in general and migratory species in particular are the obvious choice. They can best locate the bright seeds dangling in the air rather than on the ground.

The slow evolutionary rate of the magnolias has been attributed, in part, to the equally slow sensory development of beetles and vice versa. Be that as it may, the ghostly white flowers and their dark-hued partners have slow-danced through time down to the present day and show no signs of giving way.

Editor's Note: -- This essay will appear in George and Elizabeth's Ellison's *Literary Excursions in the Southern Highlands: Essays on Natural History* to be published on October 31, 2016 by The History Press in Charleston SC.

Botanical Brainteasers

By Joe Pollard and Janie Marlow

Our spring Brainteasers [Chinquapin 24(1)] were (1) *Lygodium palmatum* (climbing fern), (2) *Comptonia peregrina* (sweet fern), (3) *Adiantum pedatum* (maidenhair fern), (4) *Asplenium rhizophyllum* (walking fern) and (5) *Azolla caroliniana* (water fern). So they're all ferns, right? Not so fast – numbers 1, 3, 4, and 5 are indeed ferns, intentionally chosen to display the huge diversity in pteridophyte leaf morphology. But number 2, despite the common name and pinnate leaves, is a flowering plant in the family Myrtaceae. So it's the odd one out.

We got an overwhelming response on this puzzle, at least a dozen people replied! Everyone correctly recognized *Comptonia* as a ferny phony. The first two responses that correctly identified all 5 species came in on the same day, submitted by Kadrin Getman and Milo Pyne, so we'll declare them joint winners (applause!). But everybody who wrote in will get partial credit, and the key to being competitive in the annual competition is to play every time. The winner at the end of volume 24 will get a copy of George Ellison's new book, currently in press, "Literary Excursions in the Southern Highlands."

For our next brainteaser, there are as usual five pictures. You need to identify them by scientific name, and then explain which is the odd one out and why it doesn't belong. As a hint, this puzzle is not about the names or classifications of the plants, but you'll find a clue in another article in this issue.

Please address all correspondence regarding Botanical Brainteasers to joe_pollard@att.net\. (That's an underscore character between first and last names.) If you prefer, send snail-mail to Joe Pollard, Biology Department, Furman University, 3300 Poinsett Highway, Greenville, SC 29605. Color photos will be posted online at http://sabs.appstate.edu/chinquapin-issues. Images are ©JK Marlow.

No. 3

No. 1

No. 4

No. 2

No. 5

Photo credit Keith Bradley

Edible Wild Plants: Chicory

By Lytton John Musselman, Old Dominion University

Like its relative lettuce, chicory (*Cichorium intybus*) was used in ancient Egypt as an aphrodisiac because the milky latex was thought to resemble semen. Chicory was likely introduced to North America as a food plant and is now commonly naturalized in the lower forty-eight states. Chicory is an attractive weed and a flowering stand is striking.

A glorious stand of chicory near Woodman in southwestern Wisconsin in August. The flowers close by mid-afternoon.

All parts of the plant are apparently edible. Young chicory shoots are used as vegetables in several Mediterranean countries. I have seen wild collected plants in the early spring in a vegetable shop in the village of Dimet on Mount Lebanon in Lebanon, and in stores in the Apulia region of Italy.

A chicory "blossom", this head is actually a collection of eleven flowers. Near Iznik (ancient Nicea), Turkey, in July.

Collecting Chicory Roots

Collecting chicory roots takes some effort. Loosen the soil with a trowel or spade so you can grasp the stem with gloved hands (the stems can be prickly), then pull the taproot out of the ground. Remove the small side roots.

Young chicory leaves and shoots sold as a green vegetable in Dimet, Lebanon in May.

Chicory Coffee Substitute

The best-known use for chicory in North America is a replacement or additive for coffee, prepared by roasting the roots and pulverizing them into a coarse brown powder. Carefully wash 10-15 chicory roots using a vegetable brush, and then dry them. Place on a cookie sheet and bake at 350 F° for 45 minutes until the roots are brown and hard so they can be easily pulverized in a coffee mill. This will make four robust cups of coffee substitute. (Recipe from Musselman and Wiggins 2013)

Winter Chicory Blanched Leaves

In late summer dig roots per instructions above. Thorough washing is not needed. Place six roots in a 3 x 4 feet plastic container filled with garden sand, so the top of the root is at soil level. Place the box of sand in a dark place but do not cover to avoid fungal growth. Within a few weeks, the white succulent leaves will emerge and can be used in salads. The roots will yield up to three crops of blanched leaves. They taste like endive (*Cichorium endiva*) but often are more bitter. Extra roots can be stored for a month to six weeks in the refrigerator, then planted ensuring a supply of fresh shoots through the winter.

Freshly dug chicory roots. The ground, roasted roots are upper right. (Image from Musselman and Wiggins, 2013).

Lytton John Musselman
8 May 2016
Read Lytton Musselman's Edible Wild Plant blog at http://fs.wp.odu.edu/lmusselm/

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species of epiphytic ferns evolved recently. After the asteroid impact that killed the dinosaurs, angiosperms began to diversify, and forests dominated by angiosperm trees flourished around the world. With these trees came a new canopy environment for ferns to colonize, and large groups of fern epiphytes radiated and diversified during this time. Consequently, epiphytic ferns constitute a large portion of the current diversity of plants: although ferns as a whole only comprise about 3% of vascular plant diversity, epiphytic ferns make up approximately 10% of all vascular epiphytic flora.

For the second chapter of my doctoral research at the University of Florida, I will determine whether the branched and dissected morphology of epiphytic ferns, which has allowed the three Appalachian species to thrive in the absence of sporophytes for thousands of years, also facilitated diversification of these families millions of years ago with the onset of angiosperm-dominated forests. To do this, I will utilize a previously published 400-taxon phylogenetic dataset of ferns. The Earl Core award will allow me to supplement this dataset by adding nucleotide sequence data for several key taxa in order to achieve a more robust phylogeny, after which I can determine whether gametophyte morphology has significantly contributed to diversification rates in epiphytic ferns by utilizing models of trait evolution in programs such as BAMM (Bayesian Analysis of Macroevolutionary Mixtures).

I have also begun work for the third chapter of my dissertation to determine what environmental conditions, if any, inhibit the production of sporophytes in some ferns. While there are no accounts of the three gametophytic species in the Appalachians ever producing adult sporophytes, there are approximately 24 additional fern species around the world that produce sporophytes in parts of their range, but not in others. In Florida, *Lomariopsis kunzeana* shows this pattern on a very small scale, producing numerous sporophytes in some small solution holes, but not in seemingly identical depressions just meters away. I am currently measuring light and temperature variation between these habitats by leaving out data loggers for a year's duration at several sites. For my fourth and final chapter, I will apply this same process to several ferns in the tropics, for which there are currently no published data. My newly collected microclimate and phylogenetic data will help us to better understand why gametophytes in the Appalachians seem to have lost the capacity for producing sporophytes. I'm grateful for having been selected for the Earl Core award, and would like to thank the Southern Appalachian Botanical Society for funding my research.

The author is a Ph.D. student in the Department of Biology at the University of Florida, Gainesville, FL.