WINTER 2019 ~ ISSUE 1 VOL. 33

Chestnut

THE JOURNAL OF THE AMERICAN CHESTNUT FOUNDATION

A BENEFIT TO MEMBERS

THE AMERICAN CHESTNUT FOUNDATION®

Meadowview Harvest ~ Photo Contest Winners ~ Annual Meeting Highlights ~ Early Resistance Screening

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IN MEMORY AND IN HONOR

A BENEFIT TO MEMBERS
THE AMERICAN CHESTNUT FOUNDATION®

Lisa Thomson

President and CEO

DEAR CHESTNUT ENTHUSIASTS,

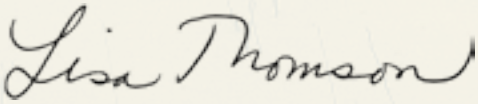
It is the time of year where all of our planted chestnuts are in winter dormancy and the rhythm of our work changes from the field to lab and database work. Why bother with a database? Because we are a science-based organization, we collect data and tons of it! These data are not just for data's sake but to help us answer important questions going forward in our breeding, biotech and bio control processes that will bring us closer to restoring an imperiled species.

Our staff scientists, collaborating researchers, and citizen scientist volunteers, all help us bring important data and research questions to the forefront of our work. The building blocks of these data collections ensure that we are making the right decisions. And let's not forget the analysis piece once we've assembled these data. Thanks to partnerships with such cutting-edge research firms as HudsonAlpha Institute for Biotechnology, and collaborators at Virginia Tech, Notre Dame, and SUNY-ESF, new questions and their answers are becoming more and more important as we move forward. TACF's science leadership team of Jared Westbrook and Sara Fitzsimmons are leading the way in data analysis and capture. And special thanks to our friends at the Ballyshannon Fund for their support of TACF's database, *dentata*Base.

It was great to see everyone in Huntsville, Alabama at our fall meeting! It was a special gathering of long time TACF supporters and some new faces as well. Our energetic keynote speaker, Dr. Deborah Barnhart, helped us dream – and dream big – with her speech "Inspiring the Mars generation" (read more on page 18). Having grown up in central Florida and seen many thrilling rocket launches, including Apollo 14 and dozens of space shuttles, it was inspiring to hear how far the U.S. space program has come since I was an impressionable teenager.

As we begin a new year, we think about the many plans for 2019 and beyond. We know we can accomplish our mission with enough time, resources, and human spirit to see us through. Thanks to all of you for giving your time, treasure, and talent to this wonderful cause that our children and grandchildren will proudly recall when walking through a forest of towering American chestnuts once again.

With gratitude,



Lisa Thomson, President and CEO
The American Chestnut Foundation

Follow me on Twitter (@MadameChestnut).

Wintry Backcross Orchard

This wintry scene of a backcross orchard was captured at the Blooming Grove Hunting and Fishing Club in northeastern PA. It was planted from 2005-2007 with about 1,600 trees. The orchard has since been fully inoculated and nuts from selected trees are being collected and sent to the arboretum at Penn State's B_3F_2 seed orchard. Photo by TACF Director of Restoration, Sara Fitzsimmons.

THE AMERICAN CHESTNUT FOUNDATION®

WHAT WE DO

The mission of The American Chestnut Foundation is to return the iconic American chestnut to its native range.

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An unexpected helper

Ek Han Tan, University of Maine and Matthew Chatfield, Unity College

Imagine walking through the forest in Maine in 2018 and finding hundreds of chestnut burs, ripe with chestnuts. It would be almost like it was 1918, before the blight devastation in this region. This is a short tale of a recent unexpected encounter with wild American chestnuts from the last vestiges of this species in its northernmost native range.

The story begins early in the morning of a crisp New England fall day; maple and birch trees in peak ruby and gold, the dry air refreshing after a week of rain. The two of us – and our friend Denise who was visiting from California – arrived at the site, gloves on and ready to collect chestnut seeds for the Maine Chapter's germplasm conservation orchards. This is a special place. Loggers had come through years go, but they left the stand of wild chestnuts. There remains two large un-blighted trees and a half dozen or so large, but blighted trees.

Fall colors reflecting on the beaver pond near the chestnut grove.

We got to work immediately. The first un-blighted tree was just beginning to drop ripe burs, and we managed to collect perhaps a hundred of them. So far so good. We were here a week earlier than last year, which was the goal because last year we only found three viable seeds beneath this tree. This year, we collected almost 60 seeds.

After a hike across a beaver dam overlooking a scenic vista, we got to the second un-blighted tree. This tree is at least 100 feet tall. This time, we did not find any viable seeds. We were too late. It remains un-blighted, however, so there's reason to be hopeful. Maybe next year?

All along our expedition, we found much evidence of the local wildlife consuming nuts. "Darn squirrels got them!" was commonly uttered in exasperation.

As the hours went by, we finally trudged up to the hillside where the remnants of a large grove of mature chestnuts once stood. All six trees were blighted, but alive. Beneath them we saw the rotting burs from last year's crop and a few burs on the dying branches above our heads. Why weren't we finding any fresh burs

Some of the many ripe burs removed from the squirrel's cache.

from this year? Was last year the final mast for this dying grove of giants?

It was beginning to feel futile. We paced around, charging on to other spots further up, adamant to find more seeds. Denise, who grew up on the west coast, had never even heard about chestnuts until we roped her into this collecting trip. She sat down by a large brush pile near a tree stump about ten feet away from the blighted trees. It was Denise who made the discovery. As she peered into the pile, she realized the entirety of the nooks and crannies of the brush pile were just chock-full of ripe, mature chestnut burs!

We set upon this pile like a pack of hungry squirrels, pulling out fruit after fruit, finding ripe chestnuts, and bagging them. Twenty burs, thirty burs, we may have found over a hundred burs, ripe with chestnuts even though we never kept count. A red squirrel had whirred angrily at us during our pillaging of its cache, intruders and poachers of its unexpected bounty. By the end of the morning, our haul totaled more than 300 seeds. Without help from the squirrel and Denise's good luck, we would've found just a fraction of these chestnuts. The seeds will now be cached in refrigerated bags until next spring, when they will be planted in a greenhouse and later transplanted into germplasm conservation orchards across much of the chestnut's range.

The authors collecting chestnuts that will become part of many germplasm conservation orchards.

We were sorry to take the squirrel's food stores, but in the long run we knew that the genetics from the seeds collected from one of the last remaining wild, native, and locally adapted chestnut groves ensures we can continue our efforts to restore this truly magnificent species. Who knows, maybe one day that squirrel's descendants will be caching chestnuts in that same spot from trees that grew from those she/he cached.

About the authors

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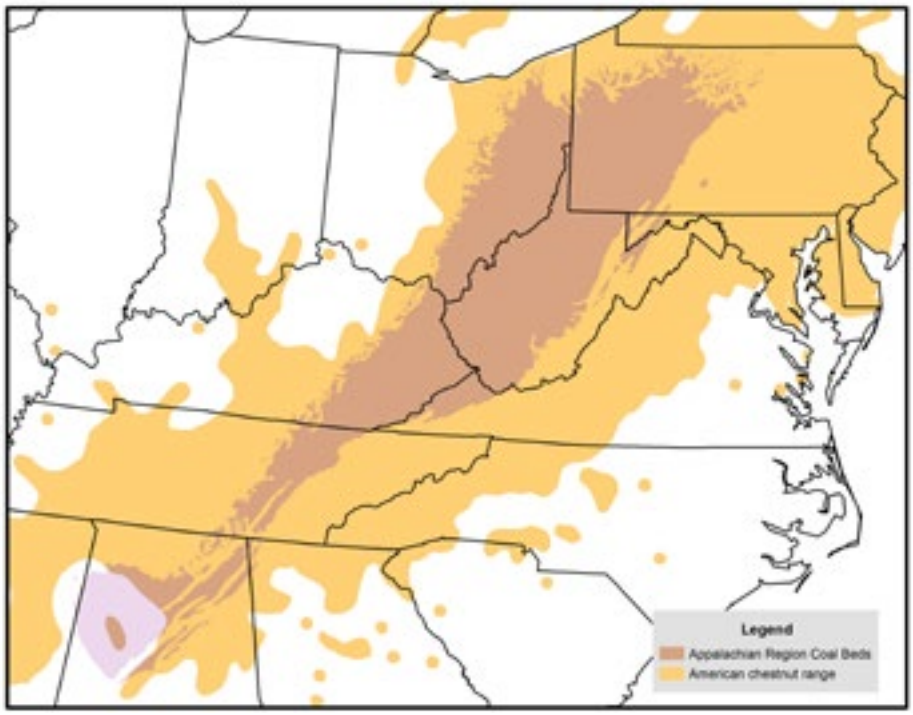
Mineland Plantings

AT LIGONIER CAMP AND CONFERENCE CENTER, LIGONIER, PA

By Sara Fern Fitzsimmons, TACF Director of Restoration

The range of abandoned minelands in the Appalachian region overlaps, almost entirely, the natural range of the American chestnut. Starting in 2005, TACF joined forces with the Appalachian Regional Reforestation Initiative (ARRI) to begin planting American chestnuts on minelands using the Forestry Reclamation Approach (FRA). Planting success on minelands primarily has to do with the type of mineland being planted, as well as how the preparatory work was done prior to planting.



There are three types of minelands on which American chestnuts have been planted: active, abandoned, and legacy. Active minelands are typically the easiest to reclaim with trees, in that the recommended FRA methodology can be applied readily, easily, and with little additional expense over traditional reclamation methods. Abandoned minelands are those which were mined prior to the implementation of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). These types of minelands are a bit harder and more expensive to reclaim with hardwood trees than active minelands.

Finally, legacy minelands, those reclaimed after the implementation of SMCRA in 1977, are the most difficult and expensive to reclaim with hardwood trees. SMCRA was passed in the late 1970s to alleviate acid mine drainage (AMD), and the primary method was to compact the soils as much as possible, reducing water infiltration and, therefore, AMD. That same compaction that reduces or prevents AMD, however, also leads to tree roots having great difficulty penetrating through those soils. Most trees planted in untreated legacy minelands do not survive.

The most effective way to treat these legacy minelands for hardwood tree planting is to cross-rip them with a large, powerful bulldozer with a ripping bar in the back. This ripping allows for the roots to then penetrate the otherwise compacted soils. The aggressive plants which can thrive in compacted soils, those such as *Lespedeza* spp. and autumn olive, must themselves be aggressively combatted with herbicides. The cost of these treatments can rise to upwards of $1,500 per acre!

In 2008, collaborators at the Ligonier Camp and Conference Center (LCCC) contacted TACF, wanting to take part in efforts to reclaim strip-mine lands with American chestnut. They planted 150 potentially blight-resistant seedlings at an abandoned mineland area on the property which they had fenced. Some of those trees are now approaching 20 feet tall and producing chestnuts!

A few years ago, staff at LCCC, wanted to supplement the abandoned mineland area originally planted in 2008, but also found another piece of their property which they wanted to reclaim, this one a legacy mine area. This spring, 250 bareroot seedlings were planted in the abandoned site while another 250 were planted in the new legacy mineland site. This newest planting was supported by the Richard King Mellon Foundation (RKMF). At the plantings, signage will be established which describes the work to restore the American chestnut and to integrate that work into mineland reclamation planting projects. An educational field day will also be held to engage some of the thousands of campers that attend LCCC every year.

Looking uphill to the planting established Spring 2018. Bareroot seedlings were installed using dibble bars and protected at the base using short, plastic tree shelters.

RKMF is invested in many projects across western Pennsylvania, especially those which "protect and restore America's environmental heritage." Since 2010, RKMF has helped fund several TACF projects across western Pennsylvania, including several related to reclaiming legacy and abandoned minelands. In this publication, we have covered one of those projects a few times, that of reclaiming the legacy mineland surrounding the Flight 93 National Memorial (see the Fall 2017 Issue for an inclusive summary of that project to date). That is an important, multi-year, and ongoing project which RKMF continues to support.

As part of the 2018 RKMF grant, TACF has or will be planting at a total of nine sites across western PA, including those at the Flight 93 and LCCC mineland plantings. Members and interested parties are invited to participate in one of the upcoming plantings. A unique opportunity to view one of the spring 2018 plantings will come during the Forest Landowners' Meeting to be held in State College, PA. In the morning of Friday, March 22, 2019, meeting participants will tour Kuhns Tree Farm where 1,000 potentially blight-resistant American chestnut bareroot seedlings were planted in the spring of 2018. Following lunch, opening remarks will be made by Chris Bolgiano, the editor of TACF seminal publication, *Mighty Giants*.

Tyler Stafinski, former intern with Ligonier Camp and Conference Center, poses with one of the largest trees from the original 2008 mineland spoil planting. The largest trees in this planting are approaching 20 feet tall and producing nuts.

2018 TACF Photo Contest Winners

There were so many great entries for TACF's 2018 Chestnut Photo Contest that narrowing down the finalists to three was a difficult task! However, it had to be done. Once those photos were chosen we asked the folks at the Asheville office's neighboring pie shop, Baked, to invite customers to pick their favorite of the three.

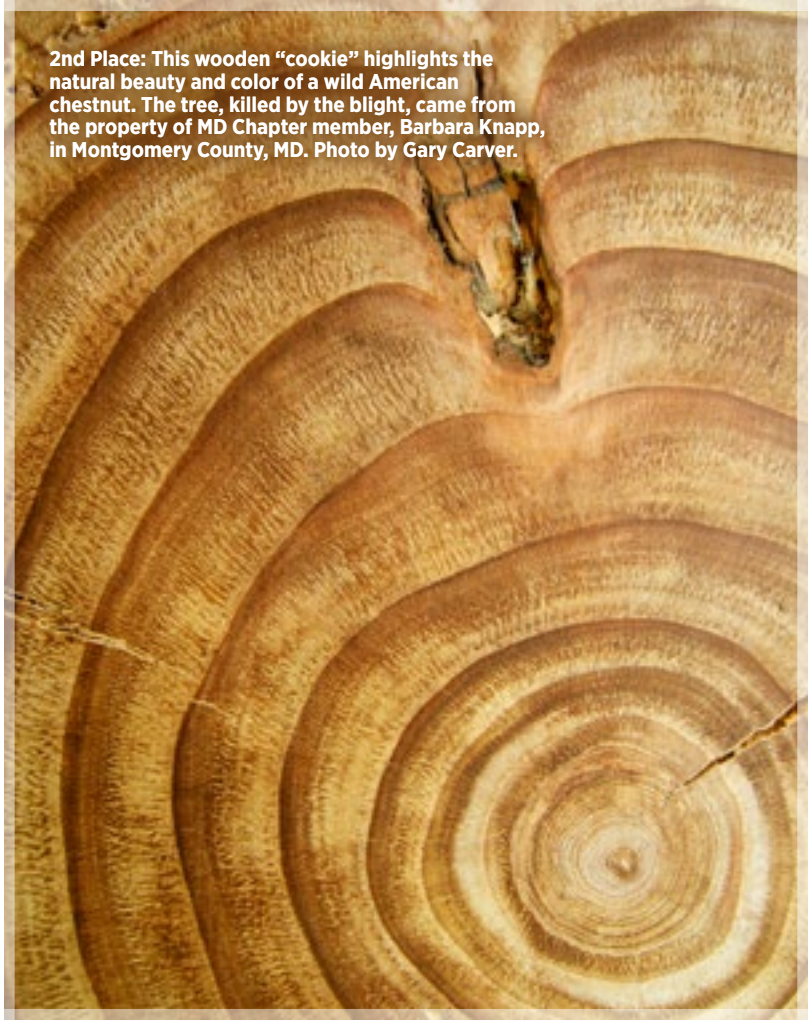
The numbers were close, but at the end of the day LAURENCE GROSSMAN came out on top! Grossman's photo titled "Gathered Chestnuts" highlights the vivid colors and attention to detail of these burs and seeds. It will appear on the cover of an upcoming issue of *Chestnut*. Congratulations, Laurence!

We would like to thank everyone who submitted photos and encourage your participation in our next contest coming this spring.

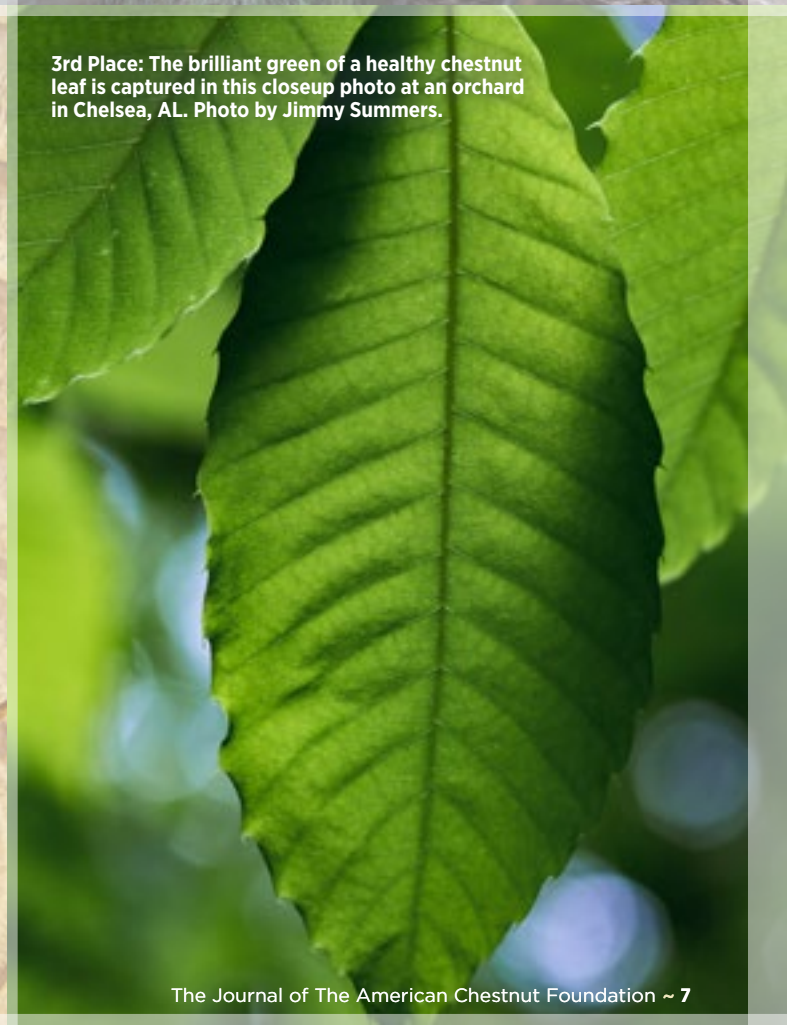
Second place winner: Gary Carver

Third place winner: Jimmy Summers

WINNER: These burs and nuts were gathered from backcross hybrid trees grown in the MD Chapter's Washington Suburban Sanitary Commission II Orchard in Montgomery County, MD.



2nd Place: This wooden "cookie" highlights the natural beauty and color of a wild American chestnut. The tree, killed by the blight, came from the property of MD Chapter member, Barbara Knapp, in Montgomery County, MD. Photo by Gary Carver.



3rd Place: The brilliant green of a healthy chestnut leaf is captured in this closeup photo at an orchard in Chelsea, AL. Photo by Jimmy Summers.

UPDATES FROM NE-1333 Meeting 2018

By Kendra Collins, New England Regional Science Coordinator

TACF's Sara Fitzsimmons led field tours of two different chestnut plantings. Here she describes the success of a B_2F_2 silvicultural trial planted in 1997 on PA Gamelands. Next, the group visited a large B_3F_2 seed orchard on the back side of PSU's arboretum property.

For 36 years, a dedicated group of chestnut scientists has met every year as part of a US Department of Agriculture (USDA) Cooperative State Research, Education, and Extension Service (CSREES) regional project. Many of the project collaborators have been involved since the project began in 1982.

That said, this is a welcoming group and the annual conference is open to participation by anyone working on American chestnut-related research. The current project, NE-1333: Biological Improvement of Chestnut through Technologies that Address Management of the Species, its Pathogens and Pests, is in its final year. It has been renewed and will continue on next year under a new project number (NE-1833).

A visit to the PSU greenhouse was the first stop on the field tour. Here, PSU's Steve Hoy (in red) discusses the small stem assays that were conducted to assess the blight resistance of small potted seedlings.

This year's meeting took place September 6-9, 2018 at the Nittany Lion Inn at The Pennsylvania State University (PSU) in State College, PA. Dr. John Carlson and members of his lab graciously hosted the group and put together a packed program. In addition to the research presentations, participants enjoyed a tour, reception, and dinner at the Penn State Arboretum, led by Arboretum Director (and TACF's Senior Science Advisor) Dr. Kim Steiner, as well as a field trip to several local chestnut sites of interest, led by TACF's Director of Restoration Sara Fitzsimmons.

There were over 20 research presentations given during this year's NE-1333 meeting. Topics ranged from genetic mapping to grafting, and true to the project's title, they covered American chestnut, chestnut blight, *Phytophthora*, and investigations of additional fungi found on chestnut.

- Dr. Sandy Anagnostakis reported on the extensive chestnut collection at the Connecticut Agricultural Experiment Station (CAES), which includes a wide

variety of species, hybrids, and cultivars. It is the largest collection of its kind in the US and now that Dr. Sandy is retired, the future of the collection could become uncertain. Establishing similar collections in secure locations is worth considering, and material from the CAES collection can be made available for this purpose.

- Dr. Hill Craddock's group from the University of Tennessee at Chattanooga presented on a variety of projects, including work by graduate student Trent Deason on grafting trees for germplasm conservation. This work was funded in part by a 2017 external grant from TACF.
- Hannah Pilkey, a graduate student with SUNY-ESF's American Chestnut Project, presented on her experimentation with various methods of highly conservative pollen collection and storage. These included use of a pollen vacuum with various filters, which is an interesting and promising new approach.
- Dr. Matt Kasson, Mark Double, and others from West Virginia University (WVU) reported on work with the new super donor strains of hypovirulent *Cryphonectria parasitica*. These strains have been engineered to overcome vegetative incompatibility barriers to natural spread and are being tested on regulated sites.
- Dr. Steve Jeffers and Andrew Gitto presented on their ongoing *Phytophtora cinnamomi* research at Clemson University, including development of an excised stem assay for *Phytophtora* resistance. The assay project was also submitted to TACF's External Grants program and awarded funding during the October 2018 TACF Board meeting.
- Dr. Laurel Rodgers and some of her undergraduate students from Shenandoah University compared fungi growing on American, Chinese, and hybrid chestnut trees. One of the more intriguing fungi Dr. Rodgers found was *Gnomoniopsis smithogilvyi*, which was not previously known as a chestnut pathogen in the US. The same fungal species was also discussed by Emily Dobry from PSU, who isolated the fungus as the cause of atypical cankering on American chestnut. There was some discussion and suspicion that this was perhaps a new classification of an otherwise known fungal species, however this was not resolved.

Notes on all presentations were taken by Secretary Mark Double, who has taken exceptional minutes for these meetings since they began in 1982. With retirement planned for December 2018, this was his last meeting as Secretary. He has long been the unofficial photographer for the group as well, and his annual humorous presentation of photos and captions from the previous years' meeting is always a high point on the agenda. Sara Fitzsimmons honored him with a similar presentation, and he was heartily thanked for his years of irreplaceable service.

For more information and minutes from this meeting, or any of the 35 preceding meetings, please visit: https://ecosystems.psu.edu/research/chestnut/meetings/crees-ne-projects

Guillaume amongst the chestnuts, fall 2001.

My Chestnut Proust Madeleine

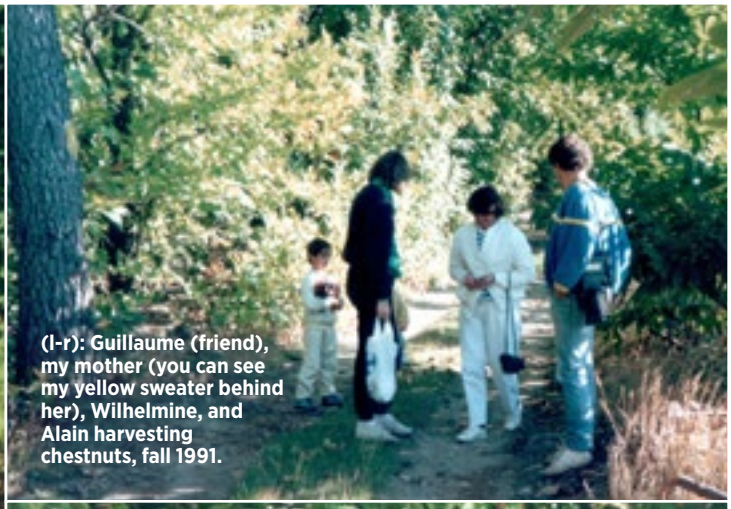
By Florian Carle, CT Chapter

I am obsessed by chestnuts. I love eating them roasted over a fire, spread on my crepes, added to my yogurts, in mousses, and every year, as a family tradition, I make a *Buche aux Marrons*, a chestnut and chocolate log shaped dessert for the winter holidays (I will share with you the recipe in the Fall 2019 issue of *Chestnut*). When I lived in France I was eating chestnuts at least once a week. I moved to Connecticut four years ago for my studies, and quickly discovered that my supply chain was cut off.

My name is Florian Carle, I am a 30-year-old French scientist. I was born in Southern France where chestnut trees are abundant (there are 744,000 hectares of forests where chestnut trees are the major species, according to the 2014 French Forest Inventory). Needless to say, being obsessed by chestnuts in France is easy. In autumn, chestnuts there are as ubiquitous as pumpkin spice in the US.

"...being obsessed by chestnuts in France is easy. In autumn, chestnuts there are as ubiquitous as pumpkin spice in the US."

Myself carrying heavy bags of chestnut back after the harvest, fall 2003.



(l-r): Guillaume (friend), my mother (you can see my yellow sweater behind her), Wilhelmine, and Alain harvesting chestnuts, fall 1991.

(l-r): My father, Alain, my sister, Pauline, Wilhelmine, Guillaume, my mother, and my happy self. La Fermigere France, fall 2001.

I attribute my love of chestnut to my mother Beatrice who passed down her taste for this amazing nut. Throughout my childhood, my parents brought my sister Pauline and me to the almost completely abandoned hamlet of La Fermigere in Ardeche, a region in France known for their chestnuts. Their friends Wilhelmine and Alain had an old house without running water or electricity in the heart of a chestnut forest.

We would often drive there after school on a Friday and arrive well after sunset. A warm and welcoming fire that my parents' friends made would await us. We played card games by the fire, patiently waiting for the morning light to go explore the forest, harvest mushrooms, and chestnuts.

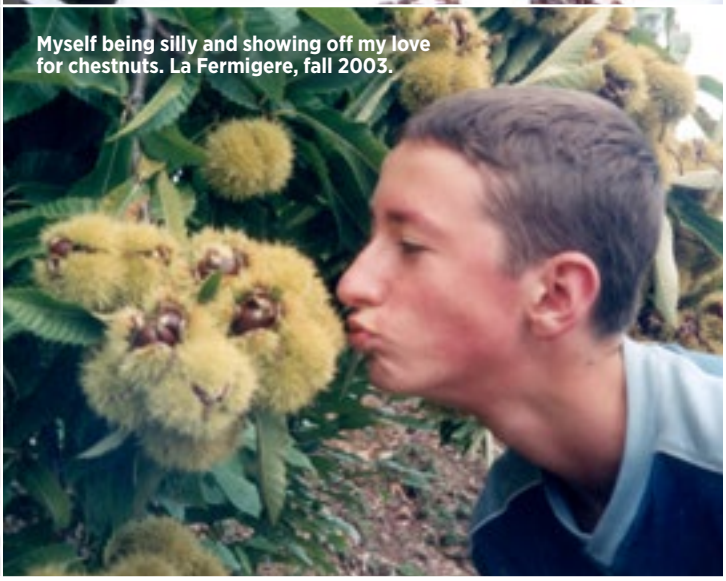
We hiked with baskets and heavy-duty plastic bags to collect chestnuts. The bounty would limit our harvest to the quantity we were able to carry back to the house. My father Jean-Claude and his friend Alain were looking for ceps and girolles (wild mushrooms) while the rest of us collected chestnuts, but the odds were stacked against them. For each mushroom they found, we easily picked up 10 times that amount in chestnuts!

I have so many fond memories of walking through the forest all day, harvesting chestnuts, looking for mushrooms, climbing the biggest chestnut trees, and telling scary stories about the isolated stone cross in the middle of the forest. Before writing this story, I looked at aerial photos of the forest to find the house we used to stay in. When I located the dirt road entrance, an olfactory memory took over and I could smell the scent of this forest for a short second.

Back at the house, we would prepare the chestnuts for dinner. We would roast some as an appetizer, or cook them as a side dish with dried apricots, mushrooms and meat. The rest of the harvest was saved and brought back home to make dozens of jars of chestnut spread. If you

Bittersweet encounter as I stand in front of a dying chestnut during a hike in the Nehantic State Forest lead by David Bingham, November 2018.

Wilhelmine and I prepare the chestnuts for a roast in the chimney, fall 2003.



Myself being silly and showing off my love for chestnuts. La Fermigere, fall 2003.

haven't tasted chestnut spread, I recommend buying a can of Clement Faugier Chestnut Spread online!

Eventually, the house was sold and became connected to the electricity grid. The dirt road to access the house became wider and more houses were built nearby. While there is a lot of forest left, even in this remote location, I feel the strain of human activity on the environment. This part of the region is still fairly protected but parcels of forest continue to be sold and transformed.

It's with great sadness that I saw my first American chestnut trees this past November. I went on a hike led by David Bingham, CT-TACF Chapter board member and amazing guide with extended knowledge of American chestnut trees. The two trees we saw were infected with the blight and will most likely be dead by next year. However, all is not lost. A few meters from the dying trees proudly stands the largest surviving native American chestnut tree in Connecticut. It was identified last summer and has no visible signs of the blight thus far. Who knows? This tree could be part of the genetic key to blight tolerance.

While the American chestnut population died out over generations, it felt to me as if their disappearance happened overnight, because of their abundance in my native France. This was a shocking loss but I know there is hope. I am glad to support The American Chestnut Foundation and its research to return the glorious American chestnut tree to its native forest.

Meadowview Harvest

By Eric Jenkins, Meadowview Tree Breeding Coordinator

The harvest season is often the busiest time of the year at Meadowview Farm, with plenty of work for staff and volunteers. It is also an unpredictable time and harvest numbers vary greatly from year to year.

This year fewer B_3F_3 nuts were harvested from our seed orchards than in previous years, with approximately 28,000 harvested this year compared to approximately 41,000 in 2017. We keep careful records of numbers of seeds collected from individual trees and staff observed that some trees which were previously laden with burs produced few or no seeds this year. Anecdotally, harvest from orchards across the chestnut range was somewhat lower overall, perhaps due to a dry summer or the more intense rainfall in September.

Other than the open pollinated seeds harvested from seed orchards, we also collected approximately 2,400 seeds from controlled pollinations conducted on the Price Farm. Most of these were for use in the "Mixed-Source" orchard we began last year. These seeds were from crosses of trees that derived resistance alleles from resistance sources other than Clapper or Graves. Our goal for this orchard is to plant at least 200 seedlings from each of 10 different

Volunteer Jonathan Sage carefully removes chestnut seeds from the prickly burs.

28,000
B_3F_3 nuts from TACF seed orchards

2,400
controlled pollination nuts

200
seedlings from 10 different sources

resistance sources, creating a genetically diverse orchard with, perhaps, resistance conferring alleles or genes that are not represented in the Clapper or Graves sources.

To produce seeds for the Mixed-Source Orchard we crossed B_2's with other B_2's, each from a different source, or B_1's with Large Surviving Americans (LSAs) that appear to have somewhat enhanced native tolerance to blight. Thus, the orchard will consist of both B_2F_2 and B_2F_1 trees which we will later inoculate and rogue, retaining the best trees just as we do in seed orchards. Our tentative hypothesis is that the average resistance of these trees will be greater than that of the B_3F_2 trees, while still retaining American characteristics.

Volunteers are the main work force in processing burs and we always receive much help from the VA Chapter's southwest branch. Dr. Han Chuan Ong recruited his Plant Biology class from King University to assist. He also brought pizza for the staff for which we were even more appreciative! Research Technician Brandon Yanez did an exemplary job of managing volunteers while also keeping meticulous records.

Ripe chestnut bur with a high number of viable seeds ready for harvest.

Members from the VA Chapter's Southwest Branch work diligently to remove, sort, and bag chestnuts.

PART 2
of a
3-part series

The American Chestnut Tree: Not Gone, Not to Be Forgotten

People are introduced to the American chestnut in surprising ways. In the first of this three-part series, Doug Gillis explored how people learn about the tree through its wood used in structures and in woodcrafts. In this second article, Doug explores how people can learn about the tree through poetry, the written word, music, and storytelling. Bits of knowledge about the tree can create memories and stimulate imagination, giving hope for its restoration. The American Chestnut Foundation (TACF) exposes people to the culture and history of the tree. At the end of this article, we invite you to share your knowledge of poetry, literature, music and stories about the American chestnut.

Learning About the American Chestnut

THROUGH WORDS AND MUSIC

by Doug Gillis, Carolinas Chapter

By Trumbull Stickney

Not all the trees are done, the branches mean,
The trunks begrimed and sodden, no, not all.
How fresh and, tho' a few, how prodigal
On yonder chestnut here and there are seen
White wisps, and, frilled about them, bits of green!
They colour on the deadness of the Fall,
They spring and with the 'lated swallows call
Happy next year into the year that's been.
O call not Nature spendthrift, and of these
Say not they bloom in error for the frost!
The sweetness of all things are promises
That sing our souls a little further on
Toward that which may be found in what is lost,
Which may come back again of what is gone.

The American Chestnut Foundation and its chapters are interested in people sharing information about the American chestnut tree. Chestnut stories of the past and present exist in poems, prose, and other literature. Such writings may include or create visual images in your mind, making the words more meaningful. Music can include lyrics accompanied by visuals or be instrumental only. Music played on an instrument made of American chestnut can express feelings about the tree we cannot put in words alone. While the tree may be functionally extinct in the wild, what we know and share about the tree keeps its culture and history alive and vibrant as we await its restoration.

I draw on my own experience in writing this article. In the next paragraphs you will get an idea of how I personally learn and weave together information about this magnificent tree.

Background image: Philadelphia's Fairmount Park was the scene for "Gathering Chestnuts," by J.W. Lauderbach. This engraving appeared in the *Art Journal* of 1878.

American chestnut violin crafted by WV Chapter member, Lou Babich.

In Chapter 13, "House-Warming," of his book *Walden*, Henry David Thoreau writes of collecting chestnuts by carrying a bag on his shoulder and a stick in his hand to open burs. He climbed chestnut trees to shake the limbs so the nuts would fall to the ground. Thoreau's account creates an image in my mind that is reinforced through the engraving "Gathering Chestnuts" by J.W. Lauderback, previous page, and it appears on TACF's website at acf.org/our-community/news/images/8912/.

"Chestnuts in November" by Trumbull Stickney (previous page) is the earliest poem I know of that is devoted entirely to the chestnut tree. It can also be found on the Poetry Nook website at poetrynook.com/poem/chestnuts-november. These poetic words "... what is lost which may come back again of what is gone" might bring up images of blighted American chestnut trees and the hope for its future. Stickney died in 1904 and could not have known of the chestnut blight. Instead, he is writing about hope in general, and that "... the sweetness of all things are promises that sing our souls a little further."

Poet Robert Frost asked the question in his poem, "Evil Tendencies Cancel," whether another parasite shall come to end the chestnut blight while the tree "keeps smoldering at the roots and sending up new shoots." Frost could not have predicted hypo-virus that keeps the blight at bay. In her book, *American Chestnut: The Life, Death, and Rebirth of a Perfect Tree*, Susan Freinkel begins Chapter 6 with the title "Evil Tendencies Cancel" and cites Robert Frost's poem. Interestingly, on one of the book's fly pages, Freinkel cites the lines from a poem, "I ... hear the children's voices shout and call and the brown chestnuts fall." The lines come from Henry Wadsworth Longfellow's poem "From my Arm-Chair." It was written to the children of Cambridge who presented him on his 72nd birthday a chair made from the wood of the chestnut tree mentioned in his poem, "The Village Blacksmith."

Dulcimer crafted by the late Michael H. Meyerhoff and donated by his daughter Sandra Meyerhoff.

Children and youth should be educated about the American chestnut tree and its significance. A short children's book, *The Legend of the American Chestnut Tree*, was written by two students at Poolesville High School (Maryland) Class of 2013 as part of their senior project for the Global Ecology Science Program. It's an easy-to-understand story about the tree and can be found on TACF's website at acf.org/resources/education/. The student authors hope is to inform young readers about the importance of the environment, specifically the restoration of the American chestnut.

In "Music of the Earth" Demarron Leif Meadows writes that the music of the earth sprouts up into the trees from which the craftsman builds a chestnut instrument, which when played, releases the music into the air to settle on the trees and return to the earth from which it came. At TACF's 35th Annual Fall Meeting in October 2018, a handcrafted American chestnut dulcimer was raffled in a fundraiser that netted more than $7,000 for the Foundation. The dulcimer was donated by Sandra Meyerhoff. Her father, the late Michael H. Meyerhoff, crafted the instrument from American chestnut wood that came from an old barn in Maryland. The previous year, an American chestnut violin was raffled at TACF's 2017 Annual Fall Meeting in Portland, ME. The instrument was handcrafted by WV Chapter member, Lou Babich.

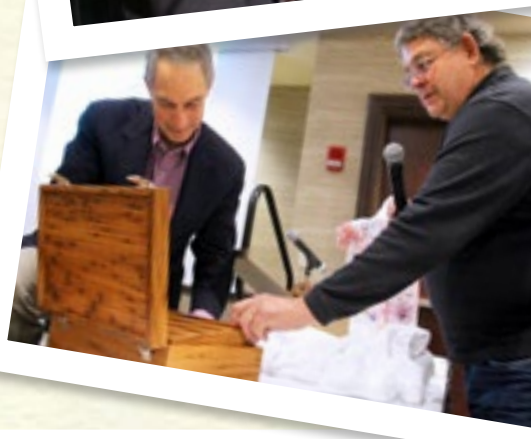
Stories are a powerful way to teach and learn about the American chestnut. Kentucky Chapter member Rex Mann was featured recently at a TEDx Talk in Youngstown, Ohio. He shared his moving story about the American chestnut tree, its significance, and the hope of restoration. The video can be found on TACF's website at: acf.org/our-community/featured-video.

Help build a list of books, poems, prose, music, and stories that use the American chestnut as a theme, by contacting Doug Gillis of the Carolinas Chapter at dgillis001@carolina.rr.com. This list will be added as a resource page on TACF's website (acf.org).

HIGHLIGHTS FROM TACF'S
35TH ANNIVERSARY CELEBRATION AND

Annual Meeting

TACF's 35th Anniversary Celebration and Annual Meeting took place October 26-27 in Huntsville, Alabama. This special anniversary event commemorated memories and milestones over the last 35 years while also looking at future advancements in American chestnut restoration. We hope you enjoy reading these highlights from the meeting and that you'll consider joining us for next year's 2019 annual meeting in historic Gettysburg, PA on October 18-19.



DR. DEBORAH BARNHART
Keynote Speaker

Our fall meeting attendees were captivated by the energetic and optimistic keynote speaker, Dr. Deborah Barnhart, Chief Executive Officer and Executive Director of the U.S. Space & Rocket Center. Since Huntsville is known as Rocket City, we thought it only fitting we should learn more about how the space program has evolved. Dr. Barnhart, a former USN Captain and a recipient of NASA's Distinguished Public Service Medal, shared the status of NASA's current goals and accomplishments, many of which were not even conceivable decades ago. She noted that the United States is the only country to successfully land on Mars, which is a mind-boggling 36 million miles from Earth. The InSight Mission, which recently touched down on the red planet, is beaming images and sharing data, and is the eighth US spacecraft to land on the red planet.

What are the parallels of space exploration to chestnut restoration? Dr. Barnhart firmly believes in the conservation and preservation of our Earth's resources, and how discoveries we learn from space travel can help us be better stewards of our own planetary home.

"I believe the reason we need to go to Mars is to develop the technologies to leave the planet, and save the planet. Because all of those things we have to master, the oxygen generation, water recycling, and so forth, are all things we can use here to improve and save our own planet."

Education of young scientists was also a key theme of her presentation. As principal founder of Space Camp, Dr. Barnhart is continually inspired by the next generation of young people. "My observation is that the Mars generation is the most amazing and intelligent group of young people ever. They are exactly who we raised them to be. We raised them to be passionate about their interests and to not waste their time on things that are not important."

When TACF began 35 years ago to "launch" our own bold mission to save a species once thought lost forever, many said it could not be done. Many also doubted we could land on the Moon, let alone another planet. These complex challenges were tackled by some of the finest scientists ever produced, knowing success could take decades. While our goals were quite different in scope and outcomes, they were amazingly similar as well. We should never underestimate the power of a good idea.

2018 Awards and Recognition

OUTGOING BOARD MEMBERS

TACF board members **Dr. Carolyn Howes Keiffer** and **David Morris** were recognized during the board meeting on Friday, October 26 for their long-term commitment and service to the board.

Carolyn has been an OH-TACF member since 1998 and served on the board from 2012-2018. She has also been an active member of the Education, Science, and Chapters Committees. Carolyn's organizational and leadership skills are greatly respected and sought after by her peers within these groups.

David has been an AL-TACF member since 2000 and served on the board from 2012-2018. He spends much of his time doing field work and handling the logistics of planning Alabama's breeding season. David has also been a champion of germplasm conservation in Alabama.

OUTGOING CHAIR

Michael Doochin's three-year tenure as TACF board chair ended at the October annual meeting. Michael has been a solid, consistent, and outstanding chair over the last three years, seeing us through growth and change. Though he has many commitments, including running his family-owned business, Michael tirelessly led the foundation and dedicated himself to his work as board chair.

During the Volunteer Service Awards Dinner on Friday, October 26, Michael, who is also an artist, was presented with a beautiful American chestnut artist box handcrafted by Carolinas Chapter President, Doug Gillis.

CHESTNUT CONSERVATION CHAMPION

Renowned musician and keyboardist for The Rolling Stones, **Chuck Leavell**, is also a conservationist, tree farmer, and American chestnut enthusiast! Chuck is a longtime member of TACF and has been planting and caring for backcross American chestnut trees at Charlene Plantation in Georgia, where he and his wife Rose Lane live when not on the road. He was awarded TACF's first Chestnut Conservation Champion Award during the meeting's 35th Anniversary Gala Dinner on Saturday, October 27 and due to his busy travel schedule, could not be there in person but an entertaining video of his acceptance speech was shared at the dinner. (To view the video of Chuck's acceptance speech, visit YouTube and search for "chestnut conservation champion.")

YEARS OF SERVICE

Don Willeke has not only been a TACF board member since its inception in 1983, he is one of its founders. President and CEO Lisa Thomson surprised Don at the Volunteer Service Awards Dinner on Friday, October 26 with a roast and special award in recognition of his 35 years of steadfast service. Don was clearly touched and videoed the whole presentation on his smartphone!

2018 Volunteer Service Awards

THE AMERICAN CHESTNUT FOUNDATION HONORS 2018 VOLUNTEER SERVICE

Award Recipients

In the fall of 2018, TACF celebrated 35 years of unwavering commitment toward American chestnut restoration at its 2018 Annual Meeting in Huntsville, AL. This kind of longevity and commitment cannot happen without the support of equally committed volunteers. Every year during this annual event, the Foundation recognizes and honors some of its most dedicated volunteers during the Volunteer Service Awards Dinner, held this year on Friday, October 26. One volunteer is chosen from each of TACF's four regions:

David Morris, Southern Region

Submitted by Betsy Heckert, AL Chapter

As a founding member and former president of the Alabama Chapter, David continues to be an active member and avid supporter of research throughout the state, including collaborative conservation efforts, travelling long distances around the state and region to collect and preserve American chestnut trees in southern populations. Serving on TACF's national board, David also manages the breeding and harvesting for all Alabama orchards. Applying his local knowledge and willingness to act as a liaison to local contacts greatly improves the reach of any researcher. Additionally, through his involvement in numerous orchard establishments and meticulous record keeping, David has generated and preserved years of data that are invaluable to the chapter and national breeding program. His contributions of time, research, leadership and expertise has spanned years, and has established David as an integral part of the organization's success in the region and state.

Tom Wild, Mid-Atlantic Region

Submitted by John Scrivani, VA Chapter

Tom is a near perfect volunteer. The VA Chapter can depend on Tom to show up when strenuous field work needs to be done and he attacks it with great energy, good cheer, and helpful suggestions to improve the work flow. As a bonus, Tom, a well-read retired geologist can be counted on for engaging and informative conversations, purging the work of any drudgery. Tom is generous with his leadership skills as well, serving on the VA Chapter Board, and in succession, Secretary and Regional Vice-President. We must compete for Tom's generous volunteer hours with his other passions, the Charlottesville Area Tree Stewards, the Ivy Creek Foundation, and the Society for Prevention of Cruelty to Animals, where Tom assists with surgery.

Joseph Reardon, North Central Region

Submitted by Carolyn Keiffer, OH Chapter

Joe Reardon (and his wife Janelle) have been actively involved in the Ohio Chapter since Ohio became a chapter in 2006. He actually attended one of the first organizing meetings in Columbus and has proved to be an extremely valuable

volunteer. Joe continues to serve on the Board of Directors and participates in many chapter plantings, workshops, seed collection, and seminars. Although he lives in Northern Ohio, he has traversed the state on behalf of TACF and is often one of the first people to volunteer for whatever task is at hand. Closer to home, Joe has given many inspiring chestnut talks, worked with several Boy Scout/Eagle Scout projects and continues to help spread the word about TACF in a variety of settings. His wife Janelle often participates in many of the activities as well and the Ohio Chapter was excited to see their efforts recognized at the annual meeting in Huntsville.

Lois Breault-Melican, New England Region

Submitted by Yvonne Federowicz and Kathy Desjardin, MA/RI Chapter

Lois has been an active board member with MA/RI-TACF since 2005. She has been Chapter President for four years, Vice President for four years before that, and serves on the TACF Chapters and Education Committees. She has initiated and guided numerous fruitful collaborations that are expanding the chapter seed orchard numbers and has facilitated the involvement of hundreds of area students in innovative projects and orchards – the next generation of "chestnutters." Her famous chestnut hermits and layer cakes keep us going! Lois is a very positive person who brings people together across our region in our work to restore the American chestnut.

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1) A view from inside HudsonAlpha Institute for Biotechnology where TACF was treated to a tour on Thursday, October 25.

2) The winner of TACF's 2018 dulcimer raffle was William Ratliff from Kentucky (pictured on left with his brother Foster). The winning ticket was drawn during the 35th Anniversary Gala Dinner on Saturday, October 27.

3) President and CEO Lisa Thomson gets roasted during a presentation by WV Chapter President Mark Double at the 35th Anniversary Gala Dinner.

4) Jeremy Schmutz, HudsonAlpha Facility Investigator, leads TACF staff and members on a tour of the facility.

5) During the HudsonAlpha tour, participants take photos of the Illumina Novaseq sequencing systems, the machines that perform the analysis of genomic sequencing.

6) A lively panel discussion took place on Saturday, October 27 and entertained many good questions from those participating.

Poster Session Awards

By Kendra Collins, New England Regional Science Coordinator

The poster session during this year's annual meeting highlighted seventeen research projects related to the restoration of the American chestnut. Research posters presented work on genomics, germplasm conservation, disease screening, spatial analysis and modelling, and novel investigations with practical application in the field. In its seventh year, the poster session provides the opportunity for both seasoned professionals and current students to present their work to their peers and the general TACF membership. This allows the annual meeting to highlight a much broader range of topics than can otherwise be accommodated by the general sessions.

For students in particular, the poster session is a great opportunity to gain experience presenting academic work. In 2017, the poster session program was expanded to include competitive student poster awards. This year six student presenters participated in the competition. All student posters were judged by two members of TACF's research community using a standard rubric, and cash prizes were awarded to those with the three highest scores.

In third place, MS of Environmental Science student Trent Deason presented his research, "Accelerated, graft-based, germplasm conservation targeting under-sampled and genetically diverse American chestnut populations allows rapid introduction of rare adaptive alleles into TACF breeding program." Trent is studying at the University of Tennessee at Chattanooga under the guidance of Dr. J. Hill Craddock, expecting to graduate in 2020.

Second place was awarded to Hannah Pilkey, a MS student at the SUNY-College of Environmental Science and Forestry. She is pursuing a Plant Science & Biotechnology degree with Dr. William Powell and expecting to graduate in 2019. Hannah's project, "Long-Term Freezer Storage of American Chestnut Pollen," highlights the need to fine-tune standard methodologies in preparation for outcrossing transgenic American chestnuts to wild-type trees.

The first place winner was Andrew Newhouse, who presented "Environmental Interactions with Transgenic American Chestnuts". His poster provided an overview of several projects aimed to determine if OxO-expressing transgenic American chestnuts behave differently than wild type trees. Along with Hannah, Andrew is at SUNY-College of Environmental Science and Forestry, with PhD advisor Dr. Powell, and he hopes to complete his advanced degree in 2020. His poster was recently reformatted into an educational web page: esf.edu/chestnut/poster.htm

Congratulations to our poster award winners, and thank you to all the students who participated!

The poster awards would not have been possible without judges, who volunteered their time to assess posters and engage with student presenters. A special thank you to Laura Barth, Dr. Deborah Delmer, Dr. Carolyn Keiffer, Dr. Brian McCarthy, Dr. Fred Paillet, and Dr. Jared Westbrook for their conscientious and thoughtful work assessing student posters.

First place winner Andrew Newhouse (r) poses with Dr. Hill Craddock at the poster display viewing area.

Third place winner Trent Deason accepts his award from Dr. Hill Craddock during the 35th Anniversary Gala Dinner.

Second place winner Hannah Pilkey discusses her poster with WV president Mark Double.

Posters and abstracts from the 2018 annual meeting are posted on TACF's website: acf.org/resources/tacf-past-annual-meetings/

2018 Annual Meeting Sponsors

THE AMERICAN CHESTNUT FOUNDATION

THANKS

these organizations who made our 35th Anniversary Celebration and Annual Meeting possible, as well as volunteers from the Alabama Chapter:

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Small stem assays

MAY BE A RELIABLE SCREENING TOOL FOR TESTING AMERICAN CHESTNUT RESISTANCE TO *CRYPHONECTRIA PARASITICA*

By Tom Saielli, Mid-Atlantic Regional Science Coordinator and Bruce Levine, MD Chapter

The American Chestnut Foundation (TACF) is screening American chestnut backcross families for blight tolerance using small stem assays (SSAs). In the small stem assay, the stems of containerized chestnut seedlings are inoculated with the fungal pathogen *Cryphonectria parasitica* and assessed for differences in blight tolerance between families. For sixteen weeks post-inoculation, volunteers and TACF staff assessed blight canker severity and survival to detect differences in blight tolerance across families. We also wanted to determine whether a strong correlation exists between the SSA and standard field inoculations.

Since 2017 TACF staff and cooperators have been experimenting with SSAs. After some initial hurdles we now see promising results. In SSAs conducted at Meadowview Research Farms and Penn State, differences in canker severity and survival were detected among BC_3F_3 families screened at both locations. There was also a correlation between survival in containerized SSAs and canker severity in field test seedlings.

2018 Progeny test results

In 2018 TACF, Penn State University, and several cooperators assisted in SSA progeny tests of Meadowview BC_3F_3s. The SSAs were performed on 30-40 seedlings from 107 BC_3F_3 families, Chinese, F_1, and American controls. The technique involved making a 1 x 5 mm incision with a cork borer and inoculated with the highly virulent Ep155 strain of *C. parasitica*.

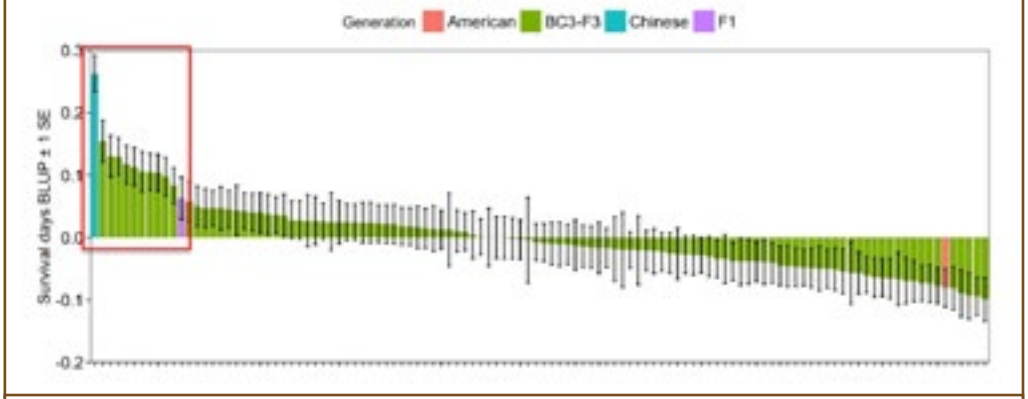
Tolerance was measured by monitoring time to wilt over 16 weeks. Time to wilt measures the number of days before seedlings wilt from the inoculation. The blight tolerance of the BC_3F_3 hybrid families and controls all segregated as expected. The Chinese controls had the highest blight tolerance, the American controls had among the lowest tolerance, and the F_1 controls had intermediate tolerance. The blight tolerance of BC_3F_3 chestnuts ranged from susceptible to intermediate. Among the BC_3F_3 families, 10 were more blight tolerant than F_1 hybrids (**Figure 1**), whereas the remaining BC_3F_3 families were less tolerant, on average. The heritability of blight tolerance, which is the proportion of variation in survival days that is genetically

Volunteers with the Kentucky and Tennessee Chapters, as well as Eastern Kentucky University and the Forest service, help plant the BC_3F_2 seedlings from the New Kent SSA program. These seedlings will be monitored for years and eventually re-screened for blight resistance. Photo by Tom Saielli.

Seedlings in the SSA trials produced a range of canker severity from A) small healing cankers, B) Intermediate cankers, to C) severe cankers. The observed variability indicates good genetic segregation among the chestnut families tested and help us determine the best, and the worst, trees and families being tested in the breeding program. Photos by Tom Saielli.

determined was 0.37 ± 0.07. These results help us determine which Meadowview BC_3F_2 parents are sufficiently blight-tolerant to keep and which ones are inferior, and need to be culled from the breeding program.

Figure 1: SSA survival spectrum in BC_3-F_3 families



"Time to wilt" was the metric by which resistance was measured for 107 BC_3F_3 families and controls. Ten families survived as long or longer than F_1s. No backcross families survived as long as Chinese chestnut controls h2 = 0.37 ± 0.07

2018 Correlation between SSAs and field tests

Among the BC_3F_3 families screened using SSAs, 37 were also evaluated for blight tolerance in field progeny tests conducted between 2011 and 2016. A goal of the SSAs this year was determining if there is a correlation between the blight tolerance rankings in the 2018 SSAs and field progeny tests. The advantage of using SSAs for progeny testing is results on family average blight tolerance can be obtained in one year versus 4 years in the field. We can also screen higher numbers of each family per year with the SSA method.

In the SSAs, the survival days measurement for blight tolerance is negatively correlated with the average canker severity of the same families inoculated in the field (r = -0.75 ± 0.30). (**Figure 2**). This confirms that blight tolerance is correlated in SSAs and field progeny tests.

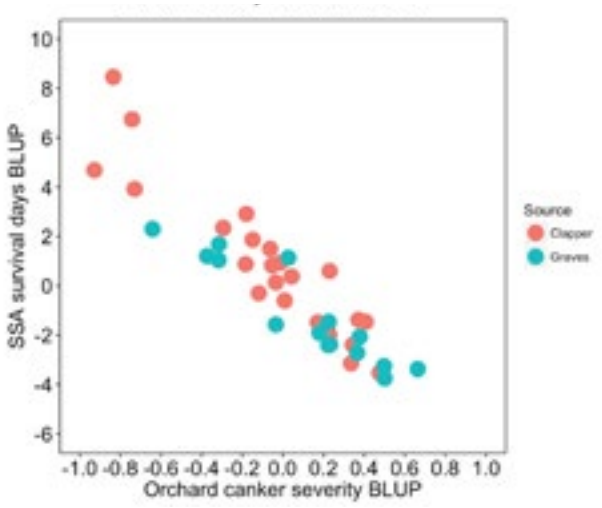
Early screening BC_3F_2s

SSAs are also being tested as a method to screen large numbers of BC_3F_2 seedlings prior to planting in seed orchards. BC_3F_2 seedlings rated roughly equivalent to F_1 controls would be planted in seed orchards. This method would allow more seedlings to be screened and require fewer trees planted in each plot. This would allow for wider spacing than the standard seed orchard protocol.

In 2018 TACF, in cooperation with the Virginia Department of Forestry, Maryland and Virginia TACF, and Virginia Master Naturalists, conducted experiments at the New Kent Forestry Center, in New Kent VA. 450 seedlings from three BC_3F_2 families (Fleming, WSSC and Hart), Chinese, American, and F1 controls were propagated in one-gallon containers and inoculated following standard SSA protocol. Cankers were assessed for twelve weeks.

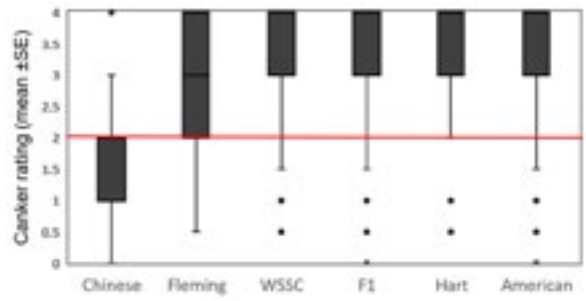
Tolerance was measured by rating cankers on a 0-4 scale (0 = completely healed, 1 = a small, callused canker, 2 = a swollen and callused cankers, 3= a large, stroma-covered cankers, and 4 = dead or dying seedlings). Chinese chestnuts were the most tolerant, American chestnuts were the least, and the F_1s and 3 BC_3F_2 families ranged from susceptible to intermediate tolerance. Of the 120-150 seedlings screened per family in this study, approximately 20-45 seedlings would be selected for transplanting to the seed orchard based on these results.

Figure 2: Survival days in SSA negatively genetically correlated with canker severity in orchard tests



Thirty-seven BC_3F_3 families screened in 2018 using small stem assays were previously inoculated in orchard progeny tests. Small stem assay time to wilt date correlated well with progeny test canker severity data (r= -0.75 ± 0.30).

Figure 3: SSA canker ratings for BC_3F_3 families and controls



Canker ratings among BC_3F_2 families and controls meet predicted values, with Chinese being most resistant, Americans being most susceptible, and F_1s and hybrids ranging from poor to intermediate resistance. Only BC_3F_2 families with scores less than or equal to 2.0 would be transplanted into seed orchards, allowing for the removal of the most susceptible (>2.0) seedlings prior to planting.

Proof of concept?

The BC_3F_2 families screened at New Kent have been planted at the seed orchard at Eastern Kentucky University, Richmond KY, where they will be re-inoculated under standard field testing protocols in 2-3 years. Results will be compared to SSA results in order to determine if enough correlation exists between the two methods to rely on SSAs for early screening in seed orchard establishment. Additionally, in a 2017 experiment, two Maryland sources of BC_3F_2 families were screened with SSAs and planted in seed orchards for long-term evaluations.

These results provide reasonable assurance that SSAs can be useful for progeny tests, and potentially as an early screening tool. The use of SSAs by TACF chapters can save valuable resources, time and labor planting and managing seed orchards, as well as improve the quality of the trees established in our orchards.

Volunteers at the New Kent Forestry Center tagging the seedlings with barcodes and prepping to ship to EKU to be planted in the seed orchard. Photo by Tom Saielli.

Volunteer collects the final canker measurements at the New Kent Forestry Center. In addition to collecting data, the volunteers are tagging the seedlings with barcodes and prepping to ship to EKU to be planted in the seed orchard. Photo by Tom Saielli.

Early Screening to Detect Resistance

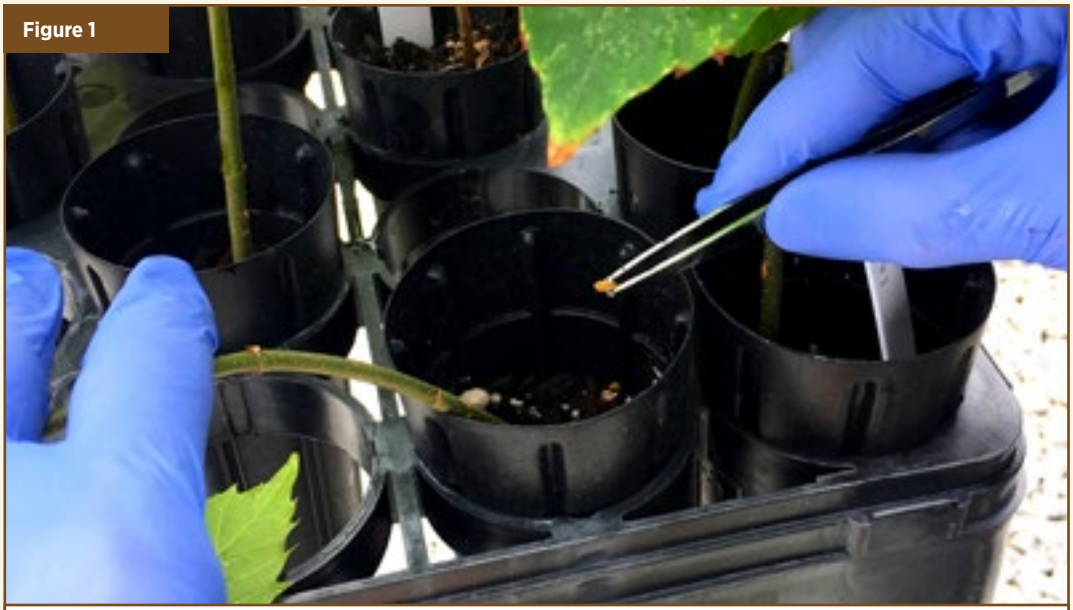
TO *PHYTOPHTHORA CINNAMOMI* IN BACKCROSS CHINESE-AMERICAN CHESTNUT HYBRIDS

Kirsten Hein, University of Tennessee at Chattanooga, Taylor Perkins, TN Chapter, Jared Westbrook, TACF Director of Science, and Hill Craddock, TN Chapter President

INTRODUCTION

Along with chestnut blight, *Phytophthora* root rot (PRR), caused by the oomycete *Phytophthora cinnamomi*, is one of the greatest obstacles to survival of American chestnut (*Castanea dentata*) in its historical range (Crandall et al. 1945; James 2011a, 2011b; Jeffers et al. 2009, 2012). Developing early and reliable PRR screening methods can facilitate efficient introgression of PRR resistance from Chinese chestnut (*Castanea mollissima*) into populations of potentially blight resistant trees by The American Chestnut Foundation (TACF) and collaborators. Selection for PRR-resistance in the breeding program's BC_3F_2 generation, or earlier, will expedite development of populations that combine the blight and PRR-resistance of *C. mollissima* with the adaptive traits of *C. dentata* (Perkins et al., in review). The purpose of our research was to diversify sources of PRR resistance in the TN Chapter's breeding program by testing backcross families for PRR resistance in their first year of growth in the greenhouse.

Figure 1



Seedlings were inoculated by placing a rice grain colonized by *P. cinnamomi* adjacent to the root crown.

Table 1: Crosses, Seed Types, and Identification Codes of the chestnut families inoculated with *P. cinnamomi* in 2016. Cross names are in the following format: female parent x male parent. Hybrid seeds were provided by The American Chestnut Foundation.

Cross	Seed Type	*Family Code	Source of Resistance	Pedigree of Mother	Pedigree of Father
C. dentata x opAm	Am	1	None	*C. dentata* x opAm	*C. dentata* x opAm
C. mollissima x opCh	Ch	2	*C. mollissima* x opCh (from Smith Farm Mix)	*C. mollissima* x opCh	*C. mollissima* x opCh
Cataloochee 2007 Tree 273 x TN-TTU-A29	B1	3	'Gideon'	*C. dentata* x opAm	TNCLA1 x Gideon
Cataloochee 2007 Tree 33 x Neel 2-127	B1	4	'Lindstrom-99'	*C. dentata* x opAm	2004 TNRUT1 x Lindstrom99
Cataloochee 2007 Tree 80 x Neel 4-195	B1	5	'Amy'	*C. dentata* x opAm	2004 TN-BF1-E10 x Amy
Cataloochee 2007 Tree 80 x Neel 8-192	B1	6	*C. mollissima* x opCh	*C. dentata* x opAm	2004 TNLIN1 x opChinese
Cataloochee 2007 Tree 80 x Pryor Seed Orchard Tree 3-50	B1	7	*C. mollissima* x opCh	*C. dentata* x opAm	Old NC10 x opChinese
Cataloochee 2007 Tree 80 x TN-TTU-A30	B1	8	'Gideon'	*C. dentata* x opAm	TNCLA1 x Gideon
GABE001-165 x GAHA14	B1	9	'Lindstrom-67'	2006 GAWA1 x Lindstrom67	*C. dentata* x opAm
Kemp Orchard Mix x opB3	B3F2	10	'Nanking' and 'Clapper'	2008 TNMON8 x JB271 and 2006 TNMON4 x IL332	N/A
Sam's 2-J mix x opB3	B3F2	11	'Clapper'	2007 TNMON8 x GR210	OP B3
TN-TTU-A30 x NCDOT American	B1	12	'Gideon'	TNCLA1 x Gideon	*C. dentata* x opAm
TN-TTU-A30 x Talladega #2	B1	13	'Gideon'	TNCLA1 x Gideon	*C. dentata* x opAm
TN-TTU-A34 x NCDOT American	B1	14	'Gideon'	TNCLA1 x Gideon	*C. dentata* x opAm
TN-TTU-C27 x TN-TTU-A30	BB1	15	'Clapper' and 'Gideon'	2004 TNSUM1 x VA89	2004 TNCLA1 x Gideon
TN-TTU-E24 x TN-TTU-A30	BB1	16	'Clapper' and 'Gideon'	2004 TNSUM1 x VA89	2004 TNCLA1 x Gideon
TN-TTU-K2 x TN-TTU-A30	BB1	17	'Clapper' and 'Gideon'	TNCLA1 x GL28	TNCLA1 x Gideon
TN-TTU-L13 x TN-TTU-A30	BB1	18	'Clapper' and 'Gideon'	TNCLA1 x GL28	TNCLA1 x Gideon
TN-TTU-M13 x TN-TTU-A30	BB1	19	'Graves' and 'Gideon'	TNCLA2 x AB248	TNCLA1 x Gideon
TNCOC1 x TN-TTU-A30	B1	20	'Gideon'	*C. dentata* x opAm	2004 TNCLA1 x Gideon
W7-32-147 x opB3F2	B3F3	21	'Graves'	Meadowview B3F2	OP B3F2

Methods

Disease screening through phenotypic evaluations can be used to determine how a host plant responds physiologically to disease pressures and to measure symptom severity of a disease in a host plant (Russell, 1978). In July 2016, container-grown seedlings were inoculated with *P. cinnamomi*, prepared on a clarified V8 agar medium, and rice-grain inoculum using the combined preparation methods of Jeffers et al. (2009) and Meadows et al. (2011) (**Figure 1**). To prevent pathogen spread in the greenhouse and nursery, the seedling containers were placed in a water-containment tray constructed on the greenhouse bench (**Figure 2**). The arrangement of the seedling containers was completely randomized.

Figure 2

Hybrid chestnut families, pre-inoculation, in a PRR-containment tray constructed on a bench in the Fortwood Street Greenhouse, Chattanooga, TN.

In January 2017, seedlings were removed from planting containers and root symptom severity was rated using the protocol developed by Jeffers et al. (2009). Root rot symptom severity was assessed on a 0-3 scale (Jeffers et al. 2009): 0 = no symptoms observed, 1 = necrotic lesions on lateral roots only, 2 = necrotic lesions on the lateral and tap roots, 3 = plant killed by root rot (**Figure 3**). Arbitrary symptom severity scales, usually dependent on the pathological system being studied, are developed to easily assess how the host plant responds to the pathogenic pressures that are visible to the naked eye. The individuals that were rated a 0, 1, or 2 at the end of the trial were repotted and monitored for an additional year in the nursery. Survivors were transplanted to a PRR symptomatic orchard. Information about the pedigrees, sources of resistance, and codes for each cross is listed in **Table 1**. Several families screened were derived from potentially new sources of PRR resistance. The Chinese chestnut ancestors of our hybrid families included the cultivars 'Lindstrom 99', 'Lindstrom 67', 'Amy', 'Gideon', and 'Nanking'.

Table 2: Chestnut seedling mortality by family, in the greenhouse and nursery (2016-2018), including: the number and percentages of seeds planted, plants inoculated, survivors at one year, and out-planted to PRR-symptomatic orchard at Tennessee Tech University, Crossville, TN.

Family Code	No. Seeds Planted (Feb. 2016)	No. Plants Inoculated (May 2016)	No. Plants Alive (Feb. 2017)	No. Seedlings Planted (Nov. 2018)
1	16	15 (94%)	11 (69%)	0 (0%)
2	12	12 (100%)	12 (100%)	12 (100%)
3	27	27 (100%)	18 (67%)	8 (30%)
4	66	63 (95%)	50 (76%)	20 (30%)
5	59	54 (92%)	48 (81%)	10 (17%)
6	23	23 (100%)	20 (87%)	10 (19%)
7	53	48 (91%)	40 (75%)	13 (25%)
8	20	17 (85%)	14 (70%)	3 (15%)
9	74	72 (97%)	56 (76%)	29 (39%)
10	9	9 (100%)	9 (100%)	5 (50%)
11	12	9 (75%)	4 (33%)	0 (0%)
12	65	54 (83%)	25 (38%)	13 (20%)
13	46	46 (100%)	45 (98%)	14 (30%)
14	64	61 (95%)	55 (86%)	42 (65%)
15	30	27 (90%)	24 (80%)	12 (40%)
16	73	68 (93%)	41 (56%)	28 (38%)
17	43	42 (98%)	34 (79%)	12 (28%)
18	10	9 (90%)	8 (80%)	0 (0%)
19	27	27 (100%)	24 (89%)	13 (48%)
20	12	12 (100%)	7 (58%)	3 (25%)
21	8	8 (100%)	5 (63%)	0 (0%)

Results & Discussion

The research objectives for the study were to identify PRR resistant hybrid crosses and to diversify sources of resistance by early phenotypic evaluation for future breeding efforts. This study tested the efficacy of implementing early and reliable screening methods for identifying PRR-resistant hybrid chestnuts in a greenhouse setting. The hybrid seedlings descended from Chinese chestnut cultivars 'Gideon', 'Amy', 'Lindstrom-99', and 'Lindstrom-67' represent the Tennessee chapter's contribution to the TACF breeding program as novel sources of resistance to chestnut blight and to PRR. They may possess different resistance alleles than the descendants of 'Clapper', 'Graves', and 'Nanking', which are the three main sources of resistance being advanced by TACF. Our hybrid family with the lowest average PRR symptom severity score (the most PRR-resistant hybrid family) was derived from 'Lindstrom-99'. The other most PRR-resistant families all descended from 'Gideon' and 'Nanking' (**Figures. 4 & 5**). 'Gideon' is a Chinese chestnut cultivar, developed and released by Greg Miller, Carrollton, Ohio, selected for its superior nut characteristics. Similarly, 'Lindstrom-99' was selected for its outstanding nut characteristics by Jerry Payne and Mike Nave from USDA plantings at Byron, Georgia (Nave 1998).

We found significant levels of resistance in families derived from four sources of resistance. A diversity of resistance alleles in the breeding population may help prevent breakdown of resistance in deployed populations (Nelson et al. 2018). Crop breeding programs, for example, must introduce new forms of resistance to evolving pathogen populations and require a supply of resistance alleles that can be incorporated into crop varieties (Nelson et al. 2018). The PRR-resistant seedlings identified here are therefore expected to help meet this need in the American chestnut restoration effort. All the surviving trees were transplanted into *Phytophthora* symptomatic orchards for further observation and evaluation (**Table 2**).

Continued

Figure 3

Kirsten Hein waited until the coldest day of the year to inspect the root systems of the potentially root rot resistant hybrids in her study.

REFERENCES

Nave, J.M. 1998. Large-Fruited Chestnuts Grown In North America. Annual Report of the Northern Nut Growers Association 89: 42-73

Crandall, B.S., G.F. Gravatt, and M.M. Ryan. 1945. Root disease of Castanea species and some coniferous and broadleaf nursery stocks, caused by *Phytophthora cinnamomi*. Phytopathology 35: 162-180.

James, J.B. 2011. *Phytophthora*: the stealthy killer. Journal of The American Chestnut Foundation 25(4): 9-11.

James, J.B. 2011. *Phytophthora*: the stealthy killer part 2. Journal of The American Chestnut Foundation 25(5): 14-17.

Jeffers, S. N., James, J. B., and Sisco, P. H. 2009. Screening for resistance to *Phytophthora cinnamomi* in hybrid seedlings of American chestnut. Pages 188-194 in: Proceedings of the Fourth Meeting of the International Union of Forest Research Organizations (IUFRO) Working Party S07.02.09: *Phytophthoras* in Forests & Natural Ecosystems. Goheen, E. M., and Frankel, S. J., tech. coords. Gen. Tech. Rep. PSW-GTR-221. US Dept. of Agriculture, Forest Service, Pacific Southwest Research Station. Albany, CA. 334 p.

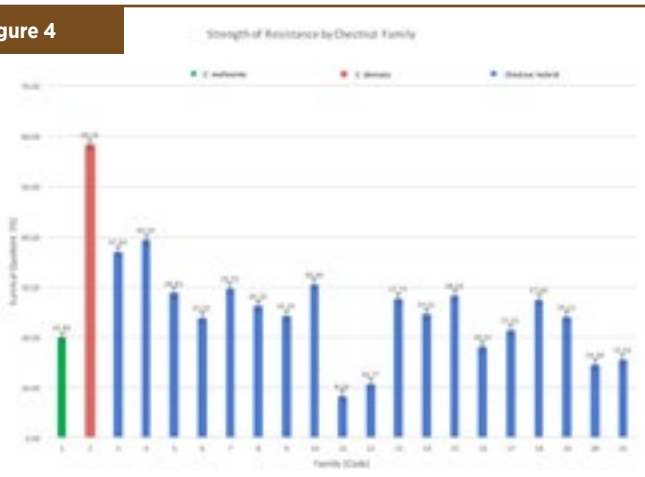
Jeffers, S. N., Meadows, I. M., James, J. B., and Sisco, P. H. 2012. Resistance to *Phytophthora cinnamomi* among seedlings from backcross families of hybrid American chestnut. Pages 194-195 in: Proceedings of the Fourth International Workshop on the Genetics of Host-Parasite Interactions in Forestry: Disease and Insect Resistance in Forest Trees. Sniezko, R. A., Yanchuk, D., Kliejunas, J. T., Palmieri, K. M., Alexander, J. M., and Frankel, S. J., tech. coords. Gen. Tech. Rep. PSW-GTR-240. US Dept. of Agric., Forest Service, Pacific.

Meadows, I. M., Zwart, D. C., Jeffers, S. N., Waldrop, T. A., & Bridges, W. C. (2011). Effects of Fuel Reduction Treatments on Incidence of Phytophthora Species in Soil of a Southern Appalachian Mountain Forest. Plant Disease, 95(7), 811-820.

Nelson, R., T. Wiesner-Hanks, R. Wisser, and P. Balint-Kurti. 2018. Navigating complexity to breed disease-resistant crops. Nature Reviews Genetics 19: 21-33.

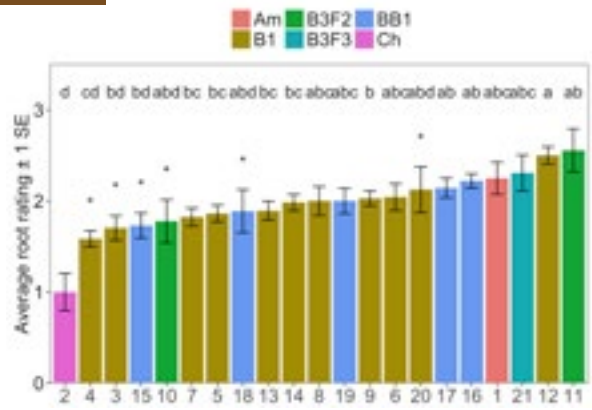
Russell, G. E., 1978. Plant breeding for pest and disease resistance. Butterworths, London, UK: 1-485.

Figure 4



Strength of PRR resistance determined by calculating the Survival Quotient. As a preliminary analysis, the strength of resistance in each hybrid chestnut family was determined by calculating the Survival Quotient (SQ), which is expressed as a percentage (Jeffers et al., 2009). Because PRR resistance in chestnut is thought to be under the control of multiple genes (Santos et al., 2017), Asian-American BC_1 hybrids are expected to retain more alleles for resistance than later generation backcrosses to *C. dentata* if parent trees were not selected for PRR resistance at every generation, as was the case with the BC_2, BC_3, and B_3F_3 progeny screened by Jeffers et al. (2009). Families with SQ values that are closer in proximity to the SQ value of *C. mollissima* were interpreted as highly disease resistant families.

Figure 5



Tukey HSD comparison for PRR resistance in hybrid families of chestnut. Families are displayed in ascending order by family code (from lowest average symptom severity score ± 1 SE to highest average symptom severity score ± 1 SE) to visualize significant differences between families and generations for PRR resistance.

*Families statistically similar to *C. mollissima*, with respect to average root rating.

There's Something in the Bark

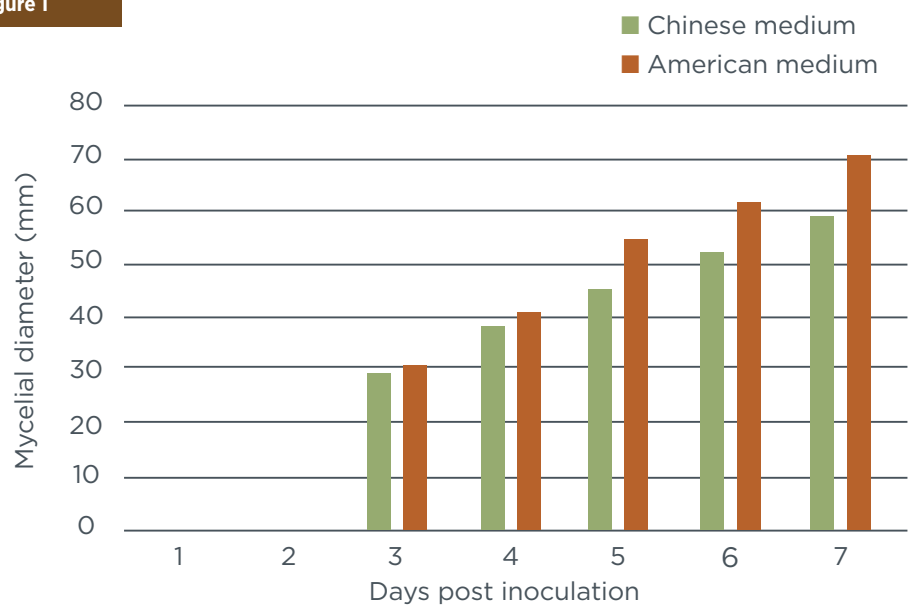
By Bruce Levine, MD Chapter and Emily Yu, Summer Intern,
University of Maryland Institute of Bioscience and Biotechnology Research

There is something in the bark of chestnut trees that at least partially explains why Chinese chestnut is more resistant than American chestnut to the chestnut blight fungus. We observed this at the University of Maryland in the summer of 2018, when we grew blight fungus (the SG2,3 strain) in Petrie dishes on chestnut bark agar (CBA), a growth medium made from water extracts of chestnut bark and agar.

We replicated the experiment three times, with ten dishes each of Chinese chestnut bark agar (CBAc) and American chestnut bark agar (CBAa). The bark in each replication was taken from Chinese and American stems with comparable diameters at the same time of year. The bark from both species was processed in the same manner, and pH levels were measured to ensure that the media differed by no more than 0.1. All Petrie dishes were inoculated with 3 mm plugs of SG2,3 mycelia.

In the first experiment, we placed all plugs directly on the medium. For the second and third, we inoculated half of each type of growth medium directly, and half with a layer of sterilized cellophane between the inoculum and the medium. We measured the diameter of the mycelium daily until the first dish in the set was completely covered with mycelia (7-8 days). We then compared growth on CBAc and CBAa by taking the average mycelial diameter on the final day of measurement (for the non-cellophane plates), and the average weight of the peeled off membrane and mycelium (for cellophane plates). In each experiment, we found that the fungus accumulated more biomass on CBAa than on CBAc (**Figure 1**).

Figure 1



Average mycelial diameter of SG2,3 colonies over seven days was consistently greater on CBAa than on CBAc media. Bark used to make the media was collected in winter of 2017. In a second replication using bark harvested in the summer of 2018, there was no significant difference in diameter, but the fungus grew more sparsely on CBAc, averaging 425 mg fresh weight at 7 pdi, compared to 632 mg on CBAa. In the third replication, which used winter 2017 bark, both diameter and fungal weight were greater on CBAa plates.

Fungus inoculated directly on the media in two out of three experiments also developed fruiting bodies on CBAa, but not on CBAc, suggesting a difference in the rate of development, as well as growth (**Figure 2**).

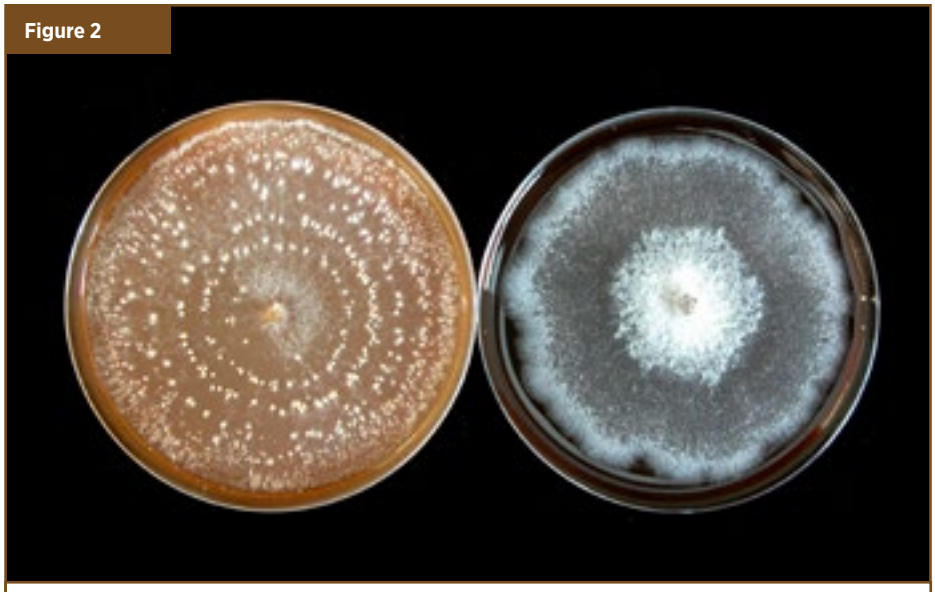
Despite over 100 years of research, the exact mechanisms by which Chinese chestnut resists chestnut blight remain unknown. Are they constitutive defenses, such as structures or anti-fungal compounds that the tree produces all the time, or induced defenses that are activated in response to infection? The results of our limited experiment help demonstrate what researchers have shown in the past – that at least some chestnut defenses are constitutive, that these compounds, when extracted, can inhibit fungal growth outside of living tissue, and that water extracts from Chinese chestnut are more inhibitory than those from American chestnuts.[1,2] Prior research has also characterized specific chemical compounds that appear to explain the difference. McCarroll and Thor reported in 1978 that phenolic compounds in aqueous extracts of Chinese chestnut bark were more effective than extracts of American chestnut bark in inhibiting fungal virulence enzymes.[3] Samman et al found two long-chained fatty acids unique to Chinese chestnut that, at certain concentrations, inhibited the growth of chestnut blight fungus by 75% and 100%, respectively.[4] Gao and Shain reported in 1995 that a proteinaceous extract from Chinese chestnut bark was 15 times more inhibitory to the virulence-related polygalacturonase enzyme produced by chestnut blight fungus than a similar extract from American chestnut.[5]

One reason that observed differences in the constitutive defenses of Chinese and American chestnut bark are important is that they show that more than one mechanism is responsible for resistance. We know that induced defenses are also involved. Hebard et al[6] described such defenses in a study of virulent and hypovirulent cankers on Chinese, American and hybrid chestnut trees in 1984. Resistant trees were quicker to create lignified barriers within their bark that could contain fungal infection, while susceptible trees were slower to produce lignin, allowing the fungal mycelial fan to push past defensive tissue within the bark. These findings are supported by later work on differential gene expression in infected and non-infected Chinese and American chestnut trees[7,8], which showed that Chinese chestnut exhibits a robust burst of activity in

defense-related genes upon infection by blight fungus, followed by a smaller burst of metabolic and repair-related genes. American chestnut, on the other hand, shows a relatively modest initial defensive response, followed by a sharp surge in metabolic and repair-related activity.

It is impossible at this point to tell how much of the difference between the two species is due to differences in constitutive defenses in the bark, and there are surely differences between the induced defenses of the two species as well. It is plausible, however, that the more robust constitutive defenses of Chinese chestnut inhibit fungal growth enough that induced defenses have more time to buildup in Chinese chestnut than they do in American chestnut. Regardless of how much of the difference in resistance between Chinese and American chestnut is due to compounds in the bark, they are clearly part of the story, and could help breeders fix blight resistance in hybrid chestnut populations. By following up previous research into the anti-fungal compounds in chestnut bark, it may be possible to identify the specific compounds that are most inhibitory to the chestnut blight fungus. It would be much easier to identify genes responsible for resistance on the basis of the presence or absence of such specific compounds than on the basis canker size, or some other trait which is difficult to measure and characterize. Even without finding genes for resistance, chemical assays could be used to accelerate selections by testing for the presence or absence of resistance-associated compounds in the bark of young seedlings. This could accelerate selection and allow us to reduce the number of genes we must select through inoculation and phenotypic evaluation.

Figure 2



Cryphonectria parasitica **strain SG2,3 growing on CBAa (left) and CBAc (right). Bark for this experiment was harvested in winter 2017. Growth on CBAc was more restricted, and the fungus did not develop fruiting bodies or exhibit the kind of zonal growth seen on CBAa. The CBAa in this replication of the experiment was lighter in color than the CBAc, but this was not consistent across replications, and did not seem to correlate with fungal growth. Photo: Bruce Levine.**

REFERENCES

1. Cook, M.T. and Wilson, G.W., "The Influence of Tannin Content of the Host Plant on *Endothia parasitica* and Related Species, " N.J. Agricultural Experiment Station, Bulletin 291, 1916.

2. Anagnostakis, Sandra, "Chestnut Bark Tannin Assays and the Growth of Chestnut Blight Fungus on Extracted Tannin," Journal of Chemical Ecology, Vol. 18, No. 8, 1992.

3. McCarroll, David, and Thor, Eyvind, "Death of a Chestnut: the Host Pathogen Interaction," in MacDonald, William L., West Virginia University, and Northeastern Forest Experiment Station (Radnor, Pa.), eds. *Proceedings of the American Chestnut Symposium: West Virginia University, Morgantown, West Virginia, January 4-5, 1978*. Morgantown: West Virginia University Books, 1978.

4. Samman, S., Schell, F., and Thor, E., "Effect of Some Compounds of American and Chinese Chestnut Inner Bark on the Growth of *Endothia parasitica*," in MacDonald, William L., West Virginia University, and Northeastern Forest Experiment Station (Radnor, Pa.), eds. *Proceedings of the American Chestnut Symposium: West Virginia University, Morgantown, West Virginia, January 4-5, 1978*. Morgantown: West Virginia University Books, 1978.

5. Gao, S and Shain, L, "Activity of Polygalacturonase produced by *Cryphonectria parasitica* in chestnut bark and its inhibition by extracts of American and Chinese Chestnut," Physiological and Molecular Plant Pathology, Vol. 46, 1995, pp. 199-213.

6. Hebard, F.V., Griffin, G.J., and Elkins, J.R., "Developmental Histopathology of Cankers Incited by Hypovirulent and Virulent Isolates of *Endothia parasitica* on Susceptible and Resistant Chestnut Trees," Phytopathology, Vol. 74, 1994, pp. 140-149.

7. Barakat, A. et al, "Comparison of the Transcriptomes of American chestnut (*C. dentata*) and Chinese chestnut (*C. molissima*) in Response to Chestnut Blight Infection," BMC Plant Biology, Vol. 9, Issue 1, 2009.

8. Barakat, A. *et al*, "Chestnut Resistance to the Blight Disease: Insights from Transcriptome Analysis," BMC Plant Biology, Vol. 12, Issue 38, 2012.

Plan Today, Give Tomorrow

By David Kaufman-Moore, TACF Donor Relations Manager

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Many of us have steadfastly contributed to retirement accounts for years, and often choose a family member as the beneficiary, should there be funds remaining after our lifetimes. However, due to other income and savings, you or your loved ones may not require your retirement account to live comfortably and you may want to consider using these assets to accomplish philanthropic goals.

"Each year we have a stronger crop of seeds and seedlings and within 50–100 years, we will have gone a long way towards restoring the American chestnut.... But it'll be after my lifetime. This is my legacy."

Board Chair Emeritus and Chestnut Society member, Dick Will

These philanthropic goals could also reap great tax benefits when designating your favorite charity as the beneficiary of your 401(k) or traditional IRA accounts. It is important to keep in mind that an individual beneficiary will have to pay income taxes as a recipient of these funds, unlike a charity beneficiary. The IRA charitable rollover is another terrific vehicle to transfer assets to charities directly from your account administrator. This can also have an added benefit if you do not need your required minimum distribution or this extra income then places you in a higher tax bracket.

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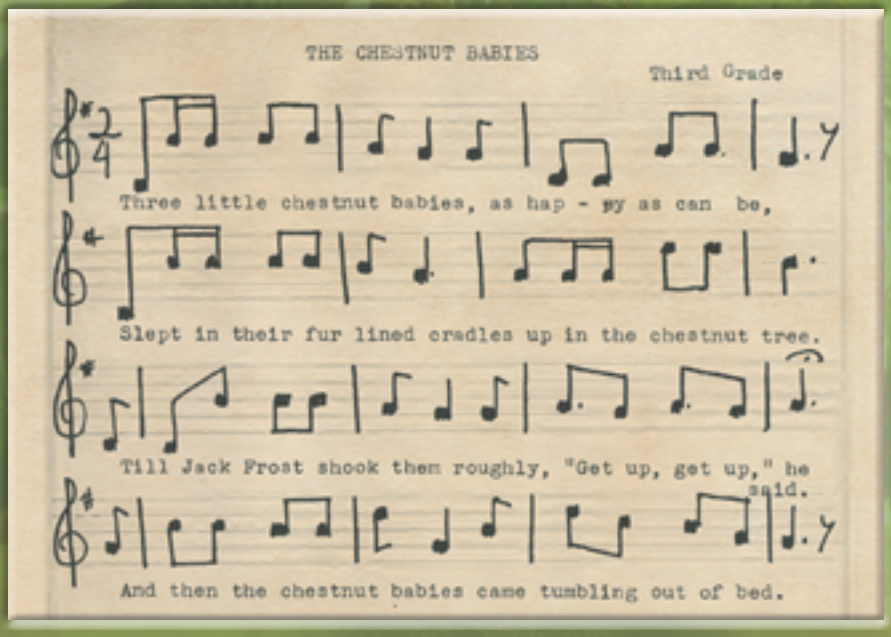
Chestnut Babies



I recently attended a meeting at the Mercer County Woodland Owners Association (MCWOA) in northwestern PA where TACF's Director of Restoration Sara Fitzsimmons gave a talk about American chestnut restoration. During her Q&A I began writing down the words to a song I remembered learning as a child called "Chestnut Babies." My intention was to show her the song's lyrics following her talk, but during a brief silence, the song just seemed to sing itself through me as I shared it with the group.

In the early 1950s I was a student at Wayne Township Consolidated School in Lawrence County, PA. Our music teacher Mr. Kanaghy came once a week and this is when I first learned the song. During the other days, classroom teachers would lead. Because I began singing at age 3, my third-grade teacher Mrs. Jordan would often ask me to lead the songs during music class, and "Chestnut Babies" was one of the songs I remembered best.

My husband and I are tree farmers and we look forward to planting potentially blight-resistant American chestnut trees on our woodlot. That's why I attended the MCWOA meeting. After singing the song there I decided to research it on the internet. I found a thesis out of Boston University that was written in 1948 by Helen Margaret Murphy about rhythms and dances for primary and elementary students. "Chestnut Babies" was included in her report.

Of all the songs I've learned throughout my lifetime I must have liked this one a lot to have remembered it all these years.

By Pamela Courtney

Chestnut Blondies

Recipe by Kathy Patrick, GA Chapter President

This delicious riff on blondies uses chestnut flour and chopped chestnuts for a lovely layered chestnut flavor.

Yield: 24 bars

Ingredients

1 cup chestnuts, peeled, roasted and coarsely chopped
1½ cups coconut, unsweetened shredded
1½ cups chestnut flour (7½ oz.)
1 tsp. baking powder
½ tsp. table salt
12 tsp. unsalted butter, melted and cooled
1½ cups light brown sugar packed (10½ oz.)
2 large eggs, lightly beaten
4 tsp. vanilla extract
1 cup white chocolate chips (6 oz.)

Method

Adjust oven rack to the middle position and heat oven to 350°. Toast coconut on a rimmed baking sheet, stirring 2 to 3 times until light golden, about 5 to 7 minutes.

While coconut toasts, cut an 18-inch length of foil and fold lengthwise to 8-inch width. Fit foil into length of 13x9-inch baking pan, pushing it into corners and up sides of pan; allow excess to overhang pan edges. Cut 14-inch length foil and fit into width of baking pan in same manner, perpendicular to first sheet. Spray foil-lined pan with nonstick cooking spray.

Whisk flour, baking powder, and salt together in a medium bowl; set aside.

Whisk melted butter and brown sugar in medium bowl until combined. Add eggs and vanilla and mix well. Using rubber spatula, fold dry ingredients into egg mixture until just combined; do not overmix. Fold in chocolate, coconut, and nuts and turn batter into prepared pan, smoothing top with rubber spatula.

Bake until top is shiny, cracked, and light golden brown, 22 to 25 minutes; do not overbake. Cool on wire rack to room temperature. Remove bars from pan by lifting foil overhang and transfer to cutting board. Cut into 2-inch squares and serve.

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