Nemophila

Newsletter of the California Botanical Society

Josie C. Lesage, Editor

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Announcements

Register for the 2020 California Botanical Society Annual Banquet!

This year's banquet will take place on April 4th at the University of California, Santa Cruz Arboretum, featuring Dr. Kathleen Kay (pictured on the right) as the keynote speaker. She will be sharing her work in a talk titled *The evolution of serpentine specialists and generalists in the California flora*.

In addition to the banquet, several exciting field trips are in the works. Keep an eye on your inbox and our Facebook page for more information soon!

To register, please visit https://calbotsoc.org/events/. For information concerning the limited availability of low-cost camping arrangements on both April 3 and 4, please contact Brett Hall at the following email address: brett@ucsc.edu

Call for Paul Silva Student Research Grant applications

It's that time of year again! The deadline for the receipt of Paul Silva Student Research Grant applications is May 15, 2020. Undergraduate and graduate students at any accredited university doing botanical research within western North America and who are members of the Society are eligible for this award.

The Paul Silva Student Research Grant is named after Paul Silva (1922-2014), a phycologist and Curator of Algae at the University Herbarium, UC Berkeley, whose bequest to the Society has made this award possible. Application details and application form are here: https://calbotsoc.org/grants/#PaulSilva

Volunteer science fair judges needed – inspire the next generation of botanists!

The California Botanical Society is hoping to expand its effort to encourage our next generation of botanists by mobilizing more volunteers to award prizes at recognized California science fairs. The Society awards prizes to exceptional 6th-12th grade student scientists for botanical projects presented their local science fairs. The society currently sponsors awards in Santa Clara and Santa Cruz, but we would like to expand this program to other counties with recognized science fairs.

If you are interested in inspiring young botanists at your local science fair with the help of the Society, please contact Justen Whittall at jwhittall@scu.edu. Justen can help coordinate judging and awards - please consider volunteering and spread the word!

Contribute to Nemophila

Nemophila is a quarterly newsletter compiling and disseminating information and announcements for the members of the California Botanical Society, as well as highlighting and sharing member news and stories. We are seeking short articles, letters to the editor, photos, and other items of interest to the members of the California Botanical Society. Do your kids love to draw plants or of botanists? Submit those too!

Please email your submissions to Nemophila editor Josie at: jclesage@ucsc.edu

Seeking grants to add to the CalBotSoc grant database

A central focus for the Society is its support of young botanists. Besides our two major grants programs, we also provide an online resource where students may easily find other grants. If you know of additional awards not currently listed in our database (https://calbotsoc.org/grants/#sources), please let our Membership Chair (membership@calbotsoc.org) know so we can add it there.

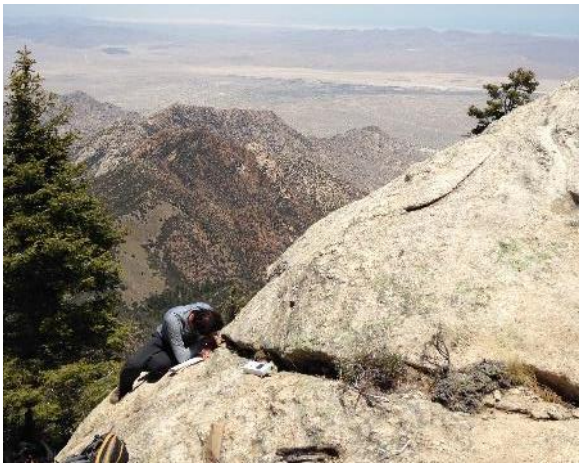
CalBotSoc grant winner updates: Daniel Winkler

Daniel Winkler was the 2014 recipient of the Annetta Carter Memorial Fund, and recently published the results of some of his work with rare plants. He received the award for his experimental work on *Heterotheca brandegeei* in high alpine Baja California, as part of his dissertation research in Travis Huxman's lab at UC Irvine.

The project brought him and a field assistant to Sierra de San Pedro Mártir National Park in México, where they traversed the rocky outcroppings of the park looking for rare, endemic species that in some cases had not been documented in more than 40 years. This field work eventually led to an undergraduate honors thesis project for Daniel's mentee and undergraduate coauthor, Michelle Lin.

Their study examined the interactive effects of increased warming and drought on this rare cushion plant, and you can find the results of their work in Conservation Physiology: *Early life history responses and phenotypic shifts in a rare endemic plant responding to climate change*.

Heterotheca brandegeei *setting seed. Photo credit: Daniel Winkler*



Daniel surveying plants growing at a cliff's edge. Photo credit: Kenny Chapin

Botanical Feature

Studying California oak vascular adaptations using new and traditional imaging methods

By Marta I. Percolla, Anna L. Jabobsen, and R. Brandon Pratt

California native oak (*Quercus*) species, occupy a wide variety of plant communities throughout California and they are often dominants elements where they occur. Like most angiosperm species, oaks transport water through vessels within their xylem tissue, but they also contain tracheids, the water transport cell type commonly found in gymnosperm species (Fig. 1). Using a variety of techniques and methods, I examined the abundance of these different types of water transport cells in five different oak species and how the function of vessels and tracheids may differ within

the plant. This work formed the basis for my MS Thesis at CSU Bakersfield, that I recently completed (Percolla, MS Thesis, CSU Bakersfield, 2019).

My research was inspired by work from the 1980's, including several publications by Sherwin Carlquist, that documented the presence of tracheids in many California woody angiosperm species and hypothesized about their function. In vessel-bearing plants, tracheids were hypothesized to be an important pathway for water transport during stress that would allow water to divert around blocked vessels. This may be especially important in long-lived species that have to tolerate water deficits and droughts, such as occur during the hot summer dry period in southern California.

As part of my research I made a wide range of measurements to quantify the xylem structure of my study species, including field measurements on plants across an elevation transect and detailed anatomical work (Fig. 2). I was also able to use advanced imaging technology (micro-computed tomography; microCT), which uses x-rays and captures 100's of high-resolution images that are reconstructed into a 3D model of the plant vascular system (Fig. 3). This approach can be used

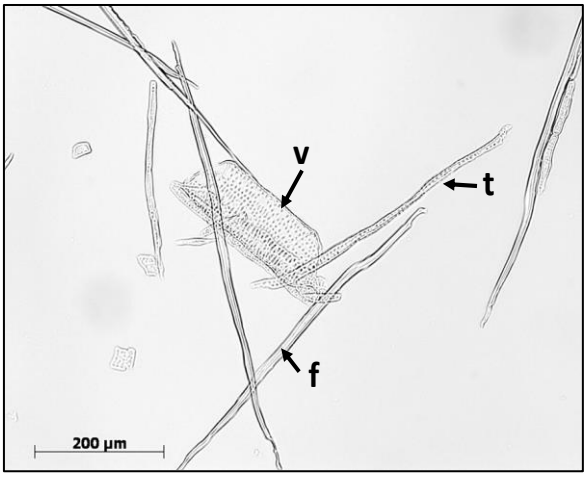


Figure 1. *Photomicrograph of Quercus kelloggii xylem that has been macerated to separate the different cell types. The most common cell types have been labeled and included vessel elements (v), tracheids (t), and fibers (f). Note the circular pits on the tracheids that are indicators of a role in water transport. These pits are absent in the fibers.*

to visualize the damage that occurs in the vascular system in response to drought. I used this new technology in combination with more traditional methods to address my research questions about how plants may or may not be equipped to respond to water stress. Using multiple methodologies to examine various parameters allowed for us to learn about plant xylem structure, as well as compile a more robust data set that

Figure 2*. Sampling oak species in the southern Sierra.*

presented a more complete picture of plant function. Additionally, by using many methodologies to compare parameters we were able to corroborate our findings.

The species that I examined differed in many of their xylem traits, including tracheid size and abundance. Tracheids were most abundant in the xylem of the highest elevation species at sites that receive winter snow and experienced freezing temperatures. Consistent with prior hypotheses, vessels were relatively vulnerable to becoming blocked by gas during even mild stress (Fig. 3 right panel), but tracheids continued to be able to conduct water even during conditions of water stress. Tracheids accounted for up to 15% of the hydraulic flow through hydrated stems, but as vessel became blocked, tracheids contributed an increasing proportion of the flow through the plant. This is an important finding and one that will no doubt stimulate more research on other taxa that contain both vessels and tracheids. This is work that I am excited to be pursuing as I initiate my PhD studies at UC Berkeley.

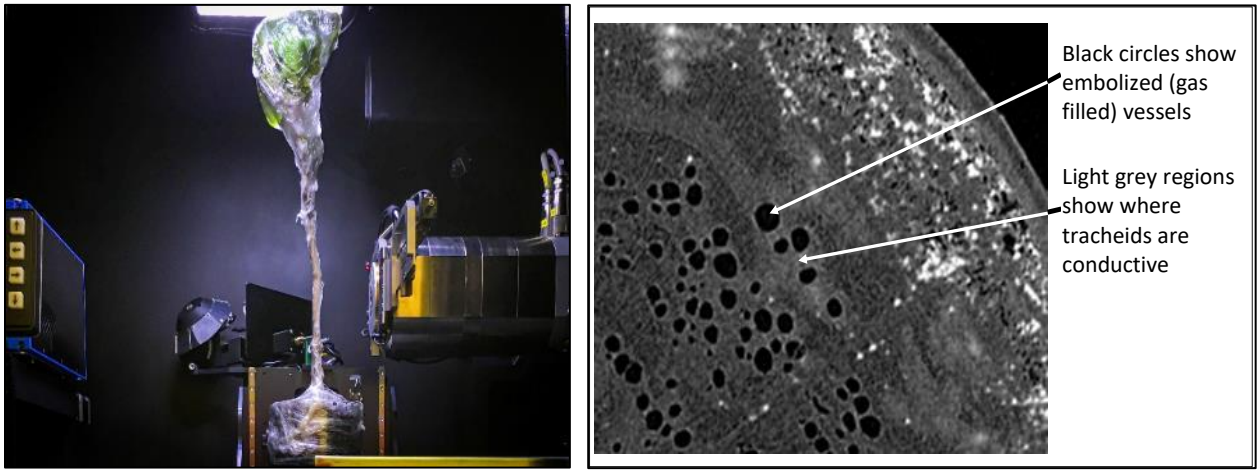


Figure 3. *The chamber within the microCT that houses specimens. Samples that are up to 50 cm may be put into the chamber and scanned (left panel). Following a reconstruction of a sample, slices of the xylem can be digitally extracted and examined to determine which cells are blocked with gas (black) and which are conductive (light grey) (right panel).*

Sign up for the Botany Ambassador Program!