Esau Award Committee Report, 2008-2009

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The Katherine Esau Award was established in 1985 with a gift from Dr. Esau and is augmented by ongoing contributions. It is given to the graduate student who presents the outstanding paper in developmental and structural botany at the annual meeting.

Seven papers were considered for the Esau Award at the Botany 2008 conference in Vancouver, BC. Papers were presented in the special student section Session 48, which was held on Tuesday July 29th from 1:00-3:30pm. Papers were judged by Kenneth Cameron (Chair), Joe Williams, and Michael Christianson, standing in for Jennifer Richards, who was unable to attend the meeting.

The Esau Award was presented to Alana Oldham, Humboldt State University Biology Dept., for her paper "Height-Associated Variation in *Sequoia sempervirens* (Coast Redwood) Leaf Anatomy: Potential Impacts on Whole-Tree Carbon Balance." Her co-authors were Stephen Stillett (Humboldt State University) and Gregory Koch (Northern Arizona University).

The paper's abstract is as follows:

The tallest tree species, coast redwood (*Sequoia sempervirens*), provides an ideal model for investigating both the adaptations allowing maximum height growth in plants and the factors that limit it. Within the crowns of tall redwoods there exists broad variation in leaf anatomy, much of which is better explained by height-induced hydraulic constraints than by differences in light environment. We analyzed the anatomy of leaves collected at 10-m intervals from both the inner and outer crowns in five redwoods 108 to 113 m tall. We found a strong decrease with height in mesophyll porosity, a factor known to limit leaf carbon fixation rates. Leaf width decreases with height while thickness increases, such that leaf cross-sectional area remains constant but the surface area to volume ratio is minimized at the treetop, again indicative of reduced gas exchange capacity per unit tissue volume. Likewise, height-associated decreases in leaf length and xylem cross-sectional area correlate with increased investment in transfusion tissue, and thus a whole-leaf vascular volume that does not significantly increase with height. Transfusion tracheids become increasingly deformed with height, which suggests that they may be collapsing under the extreme water stress of the upper crown and thus acting as a hydraulic buffer that mitigates leaf water stress and reduces the likelihood of xylem dysfunction. The height-driven decrease in water potential may directly explain the observed changes in leaf anatomy, which may serve to improve desiccation tolerance where it is needed most. These same anatomical changes correspond to the observed increase in leaf mass/area ratio and decreases in photosynthetic capacity and internal gas-phase conductance in redwood. Thus, height-induced hydraulic stress appears to drive a gradient in leaf anatomy that may have a profound effect on whole-tree carbon balance as maximum height is approached in Earth's tallest plants.

The Esau Committee also judges the best Developmental/Structural poster presented in the general poster session. The Best Poster Award was presented to Meicenheimer, Roger D., Coffin, Douglas W. and Chapman, Eric M., all from Miami University, OH, for their poster "To Break or Not To Break? – It's What's Inside that Counts!"

The abstract for their poster is as follows:

Differences in the flexibility of *Pinus nigra* and *Pinus resinosa* leaves can be used to discriminate these two similarly looking pine species from one another. When bent along the longitudinal axis, *P. resinosa* leaves "snap", while *P. nigra* leaves appear "flexible". This useful field test has had no known biophysical or anatomical explanation until now. Flexible leaves of *P. nigra* fail in compression, while brittle *P. resinosa* leaves fail in tension when subject to longitudinal bending. First order, mechanical analysis of bending and buckling was applied to the pine needles to elucidate the important anatomical differences between these two species, which can account for their different biophysical behavior when subject to bending. There was no significant difference in the cross section of the total leaf area, or the inner core (endodermis + transfusion tissue + vascular bundles) area between the two species. *P. nigra* had a thicker outer core (epidermis + hypodermis), but this could not account for the differences in the biophysical behavior of the two species leaves. Our investigation revealed that it was differences in the pattern of cell wall thickening and lignification of the endodermal layer of the inner core of the leaves that best explains the differences between bending behavior of the two species.

For 2009 at least six papers will be judged in Snowbird for the Esau Award. These student talks will be presented back to back during Session 50 on Tuesday, July 28th, 1:30 pm to 3:15 pm in the Wasatch B/Cliff Lodge - Level C. This year’s judges will be Jennifer Richards, Joe Williams and Kenneth Cameron.