Best Poster Awardee – Postdoctoral Category

Lucas Busta recently completed his PhD with Reinhard Jetter at the University of British Columbia where he studied the structures and biosynthesis of cuticular waxes in diverse plant species. He is currently a postdoctoral researcher in Edgar Cahoon's lab at the University of Nebraska - Lincoln. There, he is studying the biosynthesis and function of polyacetylenic lipids in flowering plants - compounds that protect plants from fungal pathogens. Apart from research, Luke enjoys writing about plant science on his blog (plantsarechemists.blogspot.com) and working in the garden with his friends. It is his goal to find a permanent position in which he can work with other passionate scientists to advance and apply phytochemistry to addressing challenges in agriculture.

Award Poster Title:
The chemical diversity, activity, and biosynthesis of bioactive carrot polyacetylenes

Lucas Busta[1], Evan LaBrant[1], Patricia Santos[2], Dylan K. Kosma[2], Edgar B. Cahoon[1]

[1]Center for Plant Science Innovation and Department of Biochemistry, University of Nebraska – Lincoln, Lincoln, Nebraska, 68588, USA
[2]Department of Biochemistry and Molecular Biology, University of Nevada, Reno, Nevada 89557, USA

As our climate becomes more variable and unpredictable, phytochemicals that contribute to plant disease resistance become ever more important research targets. A class of lipid compounds called polyacetylenes are produced in various Apiaceae (e.g. carrot, coriander) and Asteraceae (e.g. sunflower, artichoke) species in response to pathogenesis. Accordingly, it has long been suspected that these compounds contribute to pathogen resistance. If this is indeed the case, knowledge of the genes involved in polyacetylene biosynthesis and accumulation could be a valuable resource for creating crops lines with improved pathogen resistance.

The recent publication of a high quality carrot genome and transcriptomes has enabled functional genomics approaches to exploring polyacetylene structure, function, and biosynthesis in this species. We began with a detailed analysis of carrot polyacetylene chemical structures and their distribution in diverse carrot tissues. After TLC purification, we identified five major (two novel) and seven trace polyacetylenes, with falcarindiol and falcarinol being the major constituents of the whole polyacetylene pool. These compounds accumulate primarily in the peel of the carrot root. Next, we purified falcarinol and falcarindiol found that mycelia of the necrotrophic fungus *Sclerotinia sclerotiorum* exhibited a 25% reduction in growth rate on substrate containing just 20μg/ml polyacetylenes. We then prepared carrot cell cultures and elicited then with mycelial protein extracts from the mold *Phytophthora megasperma*. This treatment caused the accumulation of several different polyacetylene species and, based on RNA-seq, the upregulation of several fatty acid acetylenase genes putatively involved in the initial steps of polyacetylene biosynthesis. We are currently in the process of evaluating the activity of these genes in heterologous systems.