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04. Botany

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Abstracts from the 2013 Oklahoma Research Day

Held at the University of Central Oklahoma

05. Mathematics and Science

04. Botany

05.04.01 Examining the Effects of Lanthionine Ketimine (LK) in Axonal Elongation in vivo

Caleb Hubbard, Andrea Holgado, Elizabeth St. John, Erica Benda, Kenneth Hensley, Taylor Baxter, Tyler Hardin,

Southwestern Oklahoma State University

Collapsin response mediator proteins (CRMPs) are cytoskeletal adaptor molecules involved in axonal elongation, alteration of cell shape, pathological disorders and neurological diseases. To further evaluate the role of CRMP2 in health and disease, we began examining the effect of CRMP2 and potential binding partners in neuronal network formation. Moreover, we reasoned that if we target CRMP2 therapeutically, we may reverse or slow-down onsets of many neurodegenerative disorders. To this end, we began a study focused on the in vivo effects of lanthionine ketimine (LK), a natural brain metabolite that binds to CRMP2. Using the nematode *C. elegans*, which expresses UNC-33, a homolog of mammalian CRMP2, we studied CRMP2 biology. In our work, *C. elegans* were grown in the presence of the cell permeable LK-ester (LKE) and synaptic connections were examined structurally. Two *unc-33* mutant strains, either expressing yellow fluorescent protein (YFP) in cholinergic neurons or green fluorescent protein (GFP) in GABAergic neurons were studied. Analysis and quantification of fluorescently labeled neuronal connectivity demonstrated that LKE positively affects the neuronal networks of these strains. For instance, animals treated with LKE showed significantly less gaps at their nerve cord and a greater percentage of fully terminated commissures. These data provide evidence for in vivo function of LKE and reveal new opportunities for therapy development when CRMP2 functionality is compromised.

05.04.02 Comparison of Leaf Area Index (LAI) of Tomato Plants Grown Under Conventional or Plasti-culture Techniques

William Phillips, Alicia Fisher,

Redlands Community College

Produce producers can use plastic-culture is a management tool to conserve water and to control weeds. The objective of this research was to compare tomato plant canopy growth under conventional (C) and plastic-culture (PC) techniques. Eight rows of tomatoes (4 pairs of rows with treatment randomly assigned within each pair) were established on Canadian soils at the Darlington Applied Agriculture Research Center (Lat. 35.58 N Long. 98.00 W). Rows were $24.1 \text{ M} \pm \text{SE } 0.18$ (78.4 ± 0.57 ft) in length. Plants were planted 1.5 m (4.5 ft.) apart. More than one variety was used, but all varieties were represented in each row. Variety was not considered as a variable in the analysis. Canopy size was estimated using a Ceptometer (AccuPar model LP-80; Decagon Devices, Pullman, WA) to measure photosynthetically active radiation (PAR) during the first week of July, 2012 when plants were mature. Four above canopy and below canopy PAR readings were made for each plant. The Ceptometer bar was held level and readings were made parallel, perpendicular, and diagonal to the row. Data were analyzed using the paired T-test procedure. Number of plants alive per row, ratio of above and below canopy PAR readings, and estimates of LAI were not different ($P > 0.40$) between C or PC treatments. In this experiment plasti-culture did not significant increase canopy size.

05.04.03 Smoke enhances germination of Phacelia strictiflora seeds

Sonya Ross, Stanley Rice,

Southeastern Oklahoma State University

Phacelia strictiflora is a wildflower that blooms abundantly after large fires in the cross-timbers forest of Oklahoma. It blooms only rarely at other times. We hypothesized that the seeds of *P. strictiflora* required exposure to smoke chemicals in order to germinate. In our experiment, the seeds germinated best in dilute smoke solution. Of several hundred seeds, only one seed germinated without exposure to smoke chemicals. When we replicated the experiment, however, a number of seeds germinated without exposure to smoke chemicals; but exposure to dilute smoke chemicals nevertheless stimulated germination relative to the controls. We therefore modified our hypothesis to state that germination of *P. strictiflora* seeds is enhanced by exposure to smoke chemicals.

05.04.04 Impact off Rootstock and Plant Spacing on Leaf Area Index (LAI) of Noiret Grape Vines During the First Year of Establishment

William Phillips, Ashton Fisher,

Redlands Community College

Grape growers can choose the rootstock (RS) and plant spacing for their vineyards. Their goal is to maximize plant canopy development, fill the fruiting zone as soon as possible and capture as much solar energy as possible to increase productivity. The objective of this research was to compare canopy development during the first year of establishment of Noiret grapes planted on three RS and spaced either 2.5 or 3.1 m apart in a split-plot design. The vineyard was established (April 10, 2012) at the Darlington Applied Agricultural Research Center (Lat. 35.58 N Long. 98.00 W) in the spring of 2012 on Canadian soils. Rows were a 50 m in length and 3.1 m apart. Noiret vines grafted on 'Riparian' or grown on 'Own' RS (three rows; Exper. 1) and vines grafted on 'Riparian' or '101' RS (two rows; Exper. 2) were spaced 2.5 m or 3.1 m apart within the row. Spacing within row was the main plot and RS was the subplot. Ceptometer readings (AccuPar model LP-80; Decagon Devices, Pullman, WA) to measure photosynthetically active radiation (PAR) on August 8. Four above and below canopy PAR readings were made for each plant. In Exper. 1, spacing vines closer together tended ($P = 0.15$) to decrease individual plant canopy size. In Exper. 2, vines grafted on '101' RS developed greater ($P < 0.09$) canopy size than vines grafted onto 'Riparian' RS. Canopy developed during the first year of growth can be impacted by within row sp

05.04.05 Which Species are at Risk? Students Assess Plants Vulnerable to Being Over Harvested

Zella Classen, Lisa Castle,

Southwestern Oklahoma State University

Students taking plant science courses at regional universities scored wild harvested plants using the United Plant Savers' At-Risk Assessment Tool. This assignment met both educational and conservation goals. Educationally, students became aware of medicinal plant uses while learning to assimilate information from many sources. From the conservation stand point, a need for a concise compilation of information regarding wild-harvested plants was identified by the United Plant Savers, a non-profit group that has created a tool to rank plants based on their vulnerability to over-harvest. Initial tests demonstrated that the assessment tool works qualitatively and mathematically, but the small number of plants scored has limited the usefulness of the tool. Student scores of plants are consistent with scores from herbalists and botanists, suggesting that the data will make a valuable contribution towards a set of rankings useful in setting conservation priorities.

05.04.06 Conservation Biology Research Projects with Service Learning

Patty Smith, Kelly Markwardt,

Tulsa Community College

For the past seven years, twenty-four undergraduate students developed and participated in research projects with some emphasis dedicated to community service. The implementation of undergraduate research at Tulsa Community College and the successes in conservation biology and plant conservation research courses through various service learning projects will be addressed. With the West Campus greenhouse facilities, students propagate plants for various research projects with service learning components. Students propagate native plants from local stock (seeds, cuttings, transplants) for West Campus flowerbeds designed and developed by the students. For example, the Native American Flowerbed showcases native plants used for foods, medicines, ceremonies, and other purposes by Native Americans; this was a collaborative project with the Native American Studies Program. Also, the Veterinary Technology Flowerbed showcases native plants toxic to animals; this is an ongoing, collaborative project with the Veterinary Technology Program. Currently, Kelly Markwardt is designing and developing a Butterfly Flowerbed for the Child Development Center. For future service learning projects, students will assist in the design and development of a Campus Community Garden with fruit tree orchard, vineyard of various fruits, and vegetable gardens. Each spring, the research students assist with the seed germination and propagation of crop plants for underprivileged community gardens.

05.04.07 Hard Times for a Weedy Vine: *Cyclanthera dissecta* Population Fluctuations in Drought

Lisa Castle, Ariel Seward,

Southwestern Oklahoma State University

Cyclanthera dissecta (Cucurbitaceae) is a weedy annual vine native to western Oklahoma. This species has been poorly studied, but is closely related to medicinal and edible species, including *Cyclanthera pedata* and agricultural weeds. We have tracked changes in a population of *Cyclanthera dissecta* near Weatherford, Oklahoma for over three years in order to determine baseline population size and effects of unusual weather conditions on this plant. There is not much research to look to, but we hope to learn about the effects of drought in southwestern Oklahoma. The horrid drought in this area caused a sharp decline in plant life in 2011 compared to 2010, and has made a comeback in 2012. These initial results provide a glimpse at the effects of climate change on plant populations in southwestern Oklahoma and will allow us to further investigate potential edible and medicinal compounds.

05.04.08 Invasive, not Heavenly: Students Track Ailanthus altissima Populations in Weatherford

Lisa Castle, Tanner Wheeler, Zella Classen,

Southwestern Oklahoma State University

Tree of heaven, *Ailanthus altissima*, has been considered both a problematic invasive and a desirable ornamental tree. Increased numbers of trees descended from intentionally planted ornamental trees may signal the start of an invasion in areas where the species has not previously been considered problematic. To test whether or not neighborhood trees were intentionally planted, students at Southwestern Oklahoma State University in Weatherford, OK counted and measured the trees or heaven and compared the distribution to that of known ornamentals. Based on the numbers of small individual trees, trees growing close together and trees growing close to human structures, we concluded that the majority of trees of heaven in Weatherford, OK were not intentionally planted. As students we hope to use the resulting baseline map to monitor population growth and track success of control measures, and to perform genetic testing to determine the source of the invasion around our campus community.

05.04.09 Mapping Invaders From Heaven: the *Ailanthus altissima* Population Illustrated

Lisa Castle,

Southwestern Oklahoma State University

Ailanthus altissima, also known as Tree of Heaven, is a rapidly growing non-native tree. Increased numbers of trees descended from intentionally planted ornamental trees may signal the start of an invasion in areas where the species has not previously been considered problematic. Student scientists ventured into the residential areas of Weatherford, OK in order to determine if Trees of Heaven are a problem in our community. Trees of Heaven were censused, mapped, measured and we concluded that the majority of the Trees of Heaven in Weatherford, OK were not intentionally planted. On-going data collection is involving more students in monitoring and conservation around the campus community.

05.04.10 Invasive Plants of the Wichita Mountains Wildlife Refuge, Comanche County, Oklahoma: A Service Learning Project

Frank Urbanski, Michael Dunn,

Cameron University

The Wichita Mountains Wildlife Refuge is arguably the largest remaining tract of southern mixed grass prairie in existence. It consists of grasslands and post oak savanna, and is home to 50 species of mammals, 240 birds, 64 reptiles and amphibians and 36 fish species, as well as almost 900 plant species. However, this repository of the natural history of the Southern Great Plains is under constant threat of invasion by non-native plants. This project takes the list of 52 plants, identified by refuge biologists as the greatest potential threats, and prepares a pamphlet for distribution to the general public. This pamphlet has two pages for each species, one for images and one for text. The text page includes family, binomial and common name, as well as field characters for the family and species, natural history, and selected points of interest for each plant. The image page shows important features, such as growth architecture, leaf, flower and fruit characters for identification by non-professionals. This project reinforces the strong research, learning, and service relationship between Cameron University and the Wichita Mountains Wildlife Refuge. And provides a valuable service for the residents of southwestern Oklahoma, by identifying important invasive plants of the region. As a student research project (FJU), under the supervision of a research mentor (MTD), this project is an excellent illustration of fulfilling Cameron University's mission of experiential learn