

DESIGN OF AUTOMATED DETECTION OF INCOMPLETE EMPTYING FROM VENTILATOR GRAPHICS: EVALUATING THRESHOLD VALUES. Nyimas Y. Isti Arief, Curtis N. Sessler, Paul A. Wetzel, and Mary Jo E. Grap, Dept. of Biomedical Engineering, Virginia Commonwealth University. Auto-PEEP stemming from incomplete emptying of breath inhalation is an undesired excessive pressure in the lungs of patients on invasive mechanical ventilator has been a hidden presence that hinders optimal care. Noninvasive indicator for the presence of auto-PEEP is known to those who specialize in ventilator graphics whom are very rare. Incomplete emptying of the breath indicative of auto-PEEP can be automatically detected through a computerized algorithm. Two distinct algorithms have been developed; the first being dependent upon pressure waveform and the second is evaluating flow waveform independent from pressure. Both algorithms are dependent upon varying threshold values. For one criterion of the threshold, the first algorithm yields a sensitivity of 84.7% and specificity of 92.6%, and the second algorithm yields sensitivity of 90.1% and specificity of 82%. Thresholds are adjustable for finding the optimum rate of detection for incomplete emptying that can eventually be used for an automated detection of auto-PEEP.

HIGH-LEVEL GPU COMPUTING IN MATLAB®: TWO CASE STUDIES OF ACCELEREYES JACKET IN BIOMEDICAL ENGINEERING APPLICATIONS. Graham S. Kelly, Charles E. Taylor & Gerald E. Miller, Dept. of Biomedical Engineering, Virginia Commonwealth University, Richmond VA. 23220. Graphical Processing Units, or GPUs, have emerged as important scientific computing tools due to their ability to handle computationally intensive algorithms in parallel, providing drastic reductions in execution time. As the demand for GPU acceleration has increased, higher-level computing languages have emerged to streamline the process of memory transfer to and from the device and executing custom kernels (e.g. CUDA, OpenCL). AccelerEyes Jacket, a GPU computing environment for MATLAB®, provides the very-high-level functionality of MATLAB® with speed and overhead superior to the native MATLAB® Parallel Computing Toolbox™. We illuminate the usefulness of Jacket through two differently structured Particle Image Velocimetry algorithms, which track particle displacement in moving fluid. These algorithms show marked improvements in execution time with minimal changes in code between the CPU and GPU variants.

Botany

THE EFFECT BY HYDROLOGIC REGIMES AND SAHDE ON ATLANTIC WHITE CEDAR (*CHAMAECYPARIS THYOIDES*) GROWTH IN THE CAVALIER WILDLIFE MANAGEMENT AREA IN CHESAPEAKE, VIRGINIA. Justin L. Weiser, Jackie Roquemore, & Robert B. Atkinson, Department of Organismal and Environmental Biology, Christopher Newport University, Newport News VA. 23606. The Virginia Department of Game Inland Fisheries began restoring a 1538-ha Atlantic white cedar (AWC) Swamp in Chesapeake, Virginia in 2007. Reestablishment of AWC is critical in restoration of this globally- threatened ecosystem. The purpose of this study is to compare morphometric parameters of two tree planting types, propagated seedlings and rooted cuttings, at two locations characterized by hydric and mesic

hydrologic regimes, which were assigned via prevalence index of wetland indicator status for non-cedar vegetation. In August 2010 and 2011, field crews quantified survivorship and growth (estimated by height, canopy diameter and stem diameter), and shade intensity at each location. Data were analyzed using t-tests and linear regressions. Growth was significantly greater ($p < 0.05$) for rooted cuttings than for propagated seedlings over one growing season and shade negatively impacted all growth indices. Growth in hydric hydrologic regime for all three morphometric parameters was less than in mesic plots ($p < 0.05$). Rooted cuttings had greater mean growth than propagated seedlings and shade is greater in the hydric plots. Reestablishment of AWC may be effective in sites that have a prevalence index of between 2.5 and 3.5; however, mesic sites might lack the self-maintenance capacity in that seeds could be destroyed by fire.

THE FLORA OF VIRGINIA PROJECT: A 2011-2012 UPDATE. Marion B. Lobstein, (Retired) Dept. of Biology, Northern Virginia C.C., Manassas, VA 22205. Virginia, for its landmass, has the most diversity of vascular plant species of any state in the United States. The colony of Virginia had the first flora, of any of the 13 colonies, the *Flora Virginica* in 1739 and last updated 250 years ago in 1762, yet Virginia does not have a modern flora. The Virginia Academy of Science for over eighty years has supported efforts to produce a modern *Flora of Virginia*. In 2001 the Foundation of the Flora of Virginia (FFVP), Inc, was formed and by May 2002 received 501(c) 3 status. Since 2001 both the Academy and the Fellows have generously given both financial and moral support to FFVP in the development of a modern *Flora of Virginia*. The publication date of the *Flora of Virginia* by the FFVP is December 2012. BRIT (Botanical Research Institute of Texas) Press will be the publisher. The *Flora of Virginia* will be a 1,500 page manual describing and aiding in the identification of the 3,200 species of vascular plants that are native or naturalized in Virginia.

SOIL COMPOSITION IN THE GREAT DISMAL SWAMP: BEFORE AND AFTER FIRE. Kristina M. Kowalski, Jackie Roquemore & Robert B. Atkinson, Christopher Newport University. The physical and chemical properties of peat soils are influenced by fire and may effect regeneration of native species, such as Atlantic white cedar (AWC) in the Great Dismal Swamp National Wildlife Refuge (GDSNWR). This study was conducted to determine soils changes associated with the 2008 South One Fire. In 1999 soil samples were collected from GDSNWR AWC stands that had not burned in at least several decades including 27 plots in 3 stands. In the summer of 2011, samples were collected from 21 plots in 5 AWC stands that burned in the 2008 South One Fire and 2 stands containing 7 plots that were unburned. Soil samples for all years and plots were collected at 10 cm depth and AWC needle samples were also collected from the 2011 plots. Grand mean bulk density increased from 0.148 g cc^{-1} to 0.214 g cc^{-1} in burned, and 0.173 g cc^{-1} in unburned stands. Grand mean carbon remained near 47.5% across all treatments. Total nitrogen increased, but in both burned and unburned stands. There were no clear trends in AWC tissue total nitrogen content.

ATLANTIC WHITE CEDAR REGENERATION IN THE GREAT DISMAL SWAMP. Shawn J. Wurst, R. B. Atkinson & J. D. Roquemore, Department of Organismal and Environmental Biology, Christopher Newport University, Newport News VA 23606. A peat-based seed bank underlies many East Coast Atlantic white

cedar (AWC) swamps, and this globally-threatened ecosystem exhibits self-maintenance through high rates of natural regeneration after a stand-clearing fire. AWC stands in the Great Dismal Swamp have been in decline for approximately 200 years at least in part due to the draining of water by ditches. In this study we report the amount of regeneration of AWC in the Great Dismal Swamp after the South One Fire of 2008. For regeneration in 8-m² plots during 2009 and 2010, regenerants were counted in 143 and 41 plots, respectively. Mean regeneration in 2009 ($26,500 \pm 23,800$ stems ha⁻¹) was not significantly different than in 2010 ($29,300 \pm 38,000$ stems ha⁻¹, Paired t-Test $P=0.315$). Regeneration rates suggest that most regeneration occurred in the first year after the fire. Regeneration rates reported in the literature were much higher for natural cedar swamps and the lower regeneration rate in the current study might be the result of low water tables coincidental with the 2008 fire.

ANTIOXIDANT ANALYSIS OF SPICES FROM THE APIACEAE. R. A. McNeive and M. H. Renfro, Dept. of Biology, James Madison Univ., Harrisonburg VA 22801. Antioxidants in one's diet are an important component of protection from cellular oxidative damage, effects of overall aging, and certain diseases such as some forms of cancer. Spices from plants have been shown not only to have antimicrobial properties, but also to contain potent concentrations of antioxidants. One plant family, the Apiaceae, has provided more spices to the human diet than perhaps any other single plant family. Therefore we analyzed the antioxidant content of seven of the spices from Apiaceae to establish an intrafamilial comparison. Results indicated these spices contained greater quantities of hydrophilic antioxidants than lipophilic antioxidants. Fennel, cumin and dill contained the greatest quantities of hydrophilic antioxidants, while celery contained the greatest quantity of lipophilic antioxidants. Fennel, cumin and dill contained significantly greater concentrations of total antioxidants compared to celery, anise, which were not statistically different from one another, but which were significantly greater than caraway, which was significantly greater than coriander. Analysis of these spices will increase our understanding of the intrafamilial variation in antioxidant production by plants and also provide valuable information for dieticians interested in considering antioxidants as a dietary component. From this, there were no large differences between fresh weight measurements and dry weight measurements of the spices. Celery was found to be no different than anise regarding antioxidants. Cumin was found to be equal to dill and fennel while caraway and coriander were each different from the other spices.

INTERACTIVE EFFECTS OF ALLELOPATHY, PHOTOPERIOD, AND TEMPERATURE ON THE GROWTH OF *CUCUMIS SATIVUS*. Catherine Daniels & Mary E. Lehman, Dept. of Biological and Environmental Sciences, Longwood University, Farmville VA 23909. Allelopathy involves the interaction of plants through the release of chemicals into the environment, often negatively affecting the growth of surrounding plants. Little is known about how variability in environmental factors interacts with allelopathy. Cucumber seedlings were grown in nutrient culture systems containing 0–0.8 mM ferulic, *p*-coumaric or salicylic acid, three common allelopathic chemicals. The seedlings were also exposed to either a 6- or 12-hour photoperiod and to either variable or constant temperatures. Some significant interactions were seen, but were not consistent across all allelochemicals and environmental conditions. The

strongest effects were seen with the reduction in allelopathic effects of salicylic acid under lower temperatures and shorter photoperiods, even when light intensity was adjusted to maintain equivalent total energy supply. Additional experiments suggest that the significant interaction is only between allelopathy and temperature.

APOMIXIS IN A PISTILLATE CLONE OF *FLUEGGEA SUFFRUTICOSA* (PHYLLANTHACEAE). Jessica Kelly & W. John Hayden, Department of Biology, University of Richmond, Richmond, VA 23173. Pistillate specimens of *Flueggea suffruticosa*, dioecious shrubs native to temperate Asia, produce viable seeds in the absence of pollen. First (spring) flowers abort shortly after anthesis but some later (summer) flowers form fruits with apomictic seeds. Summer flowers, fruits, and seeds from plants cultivated in central Virginia were studied via light microscopy to document development of apomictic seeds. Ovules are hemitropous, bitegmic, crassinucellate, with nucellar beaks and obturators. Embryo sacs abort shortly after anthesis; nevertheless, many ovaries and ovules persist and grow despite absence of embryos. The hypostase region is responsible for some post-anthesis growth of unfertilized ovules but no apomictic embryoids were observed in this region; approximately 90% of these abort after enlarging three times greater than their size at anthesis. In about 10 % of post-anthesis ovules studied, adventitious embryony initiates ca two weeks post anthesis via mitotic proliferation of nucellus cells located in the general vicinity of the former egg apparatus. Early apomictic embryoids are irregular masses of cells; ordinary basal cells and suspensors cannot be distinguished. Mature apomictic seeds possess bi-layered sclerified testa and straight dicotyledonous embryos surrounded by relatively empty nucellus cells; only one apomictic seed studied possessed densely cytoplasmic nucellus cells. This is the first report of apomixis in Phyllanthaceae.

POLLINATOR PREFERENCE BASED UPON ULTRAVIOLET CUES. L. Abbott & L. Horth, Dept of Biology, Old Dominion University, Norfolk, Va. 23529. Pollinators are responsible for 1/3 of all the food that humans consume. This accounts for 15 billion dollars in food crops annually. Ultraviolet Cues are a way to attract pollinators to these crops. Ultraviolet cues are rays that are emitted from the sun and absorbed by the petals of the plant producing a black ring. Two experiments were performed one on *Rdubekia hirta* and one on *Ranunculus* sp. In both of these experiments bees were monitored for their preference between large UV cues and small UV cues. In the *R. hirta* experiment three flower types were used: an enhanced flower (90% of the flower petal had an ultraviolet cue), a cut and paste control flower (roughly 45% cue), and an unmanipulated flower (roughly 45% cue). This same manipulation was done in one of the subset experiments for the buttercup. The other subset of the *Runculus* experiment was monitoring natural UV cues to see if the small margins in UV had an effect on what flowers bees chose. In all experiments the pollinators showed preference to the large Ultraviolet cues. Pollinators chose the large ultraviolet cues in; wild *R. hirta*, cultivated *R. hirta*, unmanipulated *Ranunculus* and enhances *Ranunculus*. Regardless of the species and treatment of the plant when the flower had a larger Ultraviolet cue pollinators chose this cue more often than a smaller UV cue. Due to the recent decline in bees, knowing what bees chose to pollinate can be a solution to sustain more crops.

ANTIOXIDANT ANALYSIS OF COMMERCIAL SPICES. D. Killeen and M. H. Renfroe, Dept. of Biology, James Madison Univ., Harrisonburg VA 22801. There is a growing awareness of the role of antioxidants as an important component of human health. Antioxidants have been implicated in preventing degenerative diseases such as cancer, cardiovascular and neurological diseases, and reducing the effects of aging. Spices have long been part of the human diet and are known to have antimicrobial properties. We investigated eleven spices from around the Mediterranean, southern and southeastern Asia, and the West Indies. Cloves (823 $\mu\text{mol TE/g dw}$) and cinnamon (387 $\mu\text{mol TE/g dw}$) contained the greatest hydrophilic antioxidant content. Sage (68 $\mu\text{mol TE/g dw}$) and rosemary (60 $\mu\text{mol TE/g dw}$) contained the greatest lipophilic antioxidant content. Overall, cloves (835 $\mu\text{mol TE/g dw}$) and cinnamon (397 $\mu\text{mol TE/g dw}$) contained the greatest total antioxidant content. Other spices analyzed were oregano, mint, marjoram, allspice, ginger, allspice, and turmeric. Results indicated that spices are very potent sources of antioxidants and can complement one another to provide a variety of antioxidant molecules. Spices can complement other dietary components such as fruits and vegetables to greatly increase available dietary antioxidants.

REHABILITATION OF RARE SPECIES POPULATIONS. Erin Gillin¹, Stephen W. Fuller¹ & Phillip Sheridan², ¹University of Mary Washington, ²Meadowview Biological Research Station. Cell tissue culture of plant seeds has been used in previous research for horticultural and commercial purposes. This study focuses on successful seed propagation for the restoration of a variety of rare and endangered species. A standard tetrazolium test was used to determine the viability of the seeds. *Platanthera blephariglottis* (Willdenow) Lindley, white-fringed orchid, and *Tetragonotheca helianthoides* L., pinelands nerve-ray, seeds were used for both cell tissue culture and soil planting propagation. In cell tissue culture the seeds were sown aseptically on nutrient full media and stored in sealed sterile bags. Orchid protocorm development was expected, but only one vessel withstood contamination long enough to see some growth before also becoming contaminated. Failure in the aseptic processes caused loss of results for the project. Additionally, no growth was seen in the soil flats. This procedure has been successful in previous research, so we suggest further development of the methods to decrease contamination growth. With attention paid to sterile technique, plantlet development should be attainable in tissue culture for application for large scale production and wild population restoration. Further work with seed stratification and soil types is also recommended.

Chemistry

ASSESSMENT OF GUIDED INQUIRY IN GENERAL CHEMISTRY LABS: A THREE YEAR PROJECT. Heather N. Anthony & Jack K. Steehler, Department of Chemistry, Roanoke College, Salem VA 24153. This project investigates student improvements in chemistry laboratories when guided inquiry experiments are added. The project investigated student anxiety levels, content learning, and student perceptions of instruction. Three years of General Chemistry 111-112 were analyzed; the first year studied included mostly cookbook experiments, while years two and three