

the control effectiveness. Blunted trailing edges, were applied to the ailerons and the horizontal tail of several high-speed aircraft and the roll control and pitch control was restored. Further research led to the development of the all-moving tail that could be moved symmetrically for pitch control and differentially for roll control. In 1949 Convair produced the delta-winged F-102 supersonic aircraft that had difficulty in achieving the desired supersonic speeds. Production was halted and NACA-Langley undertook an investigation of the concept. A major revision involved the application of the transonic area rule that resulted in slimming the body in the region of the wing attachment- the coke bottle` contour. The transonic drag rise was reduced, supersonic speed was achieved and production was resumed. Wind tunnel tests in conjunction with analytical results can be useful in determining the performance characteristics of existing aircraft. One example is the Soviet MiG-25 airplane first seen in a 1967 airshow. The airplane was said to be capable of Mach number 3 flight. There was some doubt of this performance in the Western World. Estimates of the overall planform and profile shape could be gotten from airshow photographs. A study was undertaken at NASA-Langley to determine the cross-sectional shape that would be required to meet the speed. A wind tunnel model was built and tests verified the speed. In 1976 a MiG-25 defected to Japan and a detailed examination of the airplane indicated that the NASA-Langley model was essentially correct.

VARIATIONS OF VARIABLE GEOMETRY AIRCRAFT. M. Leroy Spearman, Langley Research Center, Hampton, VA. The geometric shape of an aircraft usually consists of a fuselage, wing and tails and a propulsion system. The fuselage provides the space required for the cargo, equipment and crew. The wing provides the lift required to sustain flight. The tails provide for stability and control. The propulsion system provides for forward movement of the aircraft. The shape and arrangement of these components are designed in such a way as to assure that the mission requirements for the aircraft are met. Thus for different mission requirements a different geometric shape is required. This led to the concept of a single aircraft having variable geometry that would be suitable for multiple missions. An example of such an aircraft is the General Dynamics F-111 in which the wing panels can be set at a low sweep position for take-off and landing and low-speed flight – for high-speed flight the wing panels are rotated back to a high sweep angle. With the F-111 the entire wing panels are moved using inboard pivots. Some research has been done with outboard pivots in which only a portion of the wing panel is swept. And some research has been done with only a single pivot wherein the entire wing is rotated into what is known as a skewed wing. Several aircraft having variable sweep wings have been produced in the U.S., and in several European countries and in the Soviet Union.

### **Agriculture, Forestry, and Aquaculture**

DOES PROXIMITY TO COMPOST PILES AFFECT FLY POPULATIONS IN HIGH TUNNEL TOMATO? Mark Kraemer, Walter Mallory & Steven Pao, Agricultural Research Station, Virginia State University, Petersburg, VA 23806. Compost is commonly used in organic vegetable production but it is not known if nearby compost piles pose a health threat. This study evaluated fly populations in two high tunnels,

with and without compost. Both tunnels had 3 rows of bush tomatoes. The treatment tunnel had tubs of manure and straw placed in each corner. Flies were monitored over a period of 10 weeks using 15 x 25 cm yellow sticky cards, one in each quadrant of each tunnel. The control tunnel was 5 m distant to the treatment tunnel. Four types of filth fly were found in the tunnels, plus hover flies and Tachinid parasitoids. The lesser house fly (*Fannia canicularis*) was the most numerous and increased over time. Other flies were the common house fly (*Musca domestica*), stable fly (*Stomoxys calcitrans*), and black garbage fly (*Hydrotaea aenescens*). There were no significant differences between filth fly populations between tunnels. Thus, a distance of greater than 5 m from compost piles is required to reduce filth fly populations.

EFFICACY TESTS OF VERNONIA LEAF EXTRACT AND FRACTIONS TO CONTROL SMALL RUMINANTS GASTROINTESTINAL PARASITES (GIN). F. Djibodé Favi, A. B. Yousuf, S. A. Wildeus, W. H. Mallory & M. E. Kraemer, Agriculture Research Station, Virginia State University, Petersburg VA 23806. Gastrointestinal nematodes (GIN), were the greatest danger to the small ruminant industry worldwide and *Haemonchus contortus* (Rudolphi) Cobb is one of the most pathogenic to ruminants. It piercing the abomasum causes a number of significant complications that can lead to death. Leave from vernonia varieties were used for thousand years in the old world to cure GIN in animal and human. Tested extracts were mostly inconclusive in 3600 documented records. The objective was to test fractions of leaf extract to determine efficacy conditions of *Vernonia galamensis* (Gilbert) from Africa. Aqueous and oily fractions from leave extract were parted to obtain concentrate fractions. Fractions were applied to larva in 12- cell plate (10 larva/ $\mu$ l) and larval mortality was accessed for three days. The controls were 30% solvent and commercial dewormers Cydectin. Eggs filtered from feces of infested animal were diluted to 50 eggs/100 $\mu$ l were tested in 12-cell plate. Hatching were monitored from 1-3 days. Cydectin kills L3 larva within 1-3 days post treatment (dose dependent). Egg leaks and the shell has a round hole. Fraction A kill larva between 1-2 days post treatment. Larva vomit struggle and die. Egg shows atypical frozen yolk. Fraction A was selected for further studies.

TEMPERATURE EXTREMES OF THE BROWN MARMORATED STINK BUG (*Halyomorpha halys*). John D. Aigner, Thomas P. Kuhar, Ashley K. Lohr, & Christopher R. Philips, Virginia Tech, Department of Entomology, 216 Price Hall, Blacksburg, VA 24061. Today's global economy continues to grow, increasing the chances that invasive species become established in the United States. Brown marmorated stink bug (BMSB), *Halyomorpha halys* (Stål), is a major agricultural pest that was accidentally introduced in Pennsylvania and is rapidly spreading throughout the North America. This project was designed to better understand the bug's physiology and its ability to withstand a range of temperatures so that we can better understand the potential climatic and geographic limitations of the insect. This was done by monitoring the lethal high temperature of BMSB and by identifying the supercooling points (SCP's) associated with BMSB at several intervals throughout the year. Field-collected and lab-reared BMSB egg masses, nymphs, and adults were exposed to temperatures ranging from 35 to 45°C (95 to 113°F) for four hours or until all bugs died, whichever was shorter. Temperatures above 41°C (104°F) resulted in

significant mortality of all stages of BMSB. All life stages of BMSB survived exposures to temperatures below 40°C (104°F). Supercooling points were determined to range from -8°C (17.6°F) to -22°C (-7.6°F) using field collected BMSB. These SCP's change throughout the year however, no discernible pattern was recognized. These SCP's have been monitored from December of 2011 through April 2013.

OMNIVORY AND PREDATOR FUNCTION IN AGRICULTURAL ECOSYSTEMS. C. R. Philips, T. P. Kuhar & D. A. Herbert, Dept. of Entomology, Virginia Tech, Blacksburg, VA 24061. Understanding how buckwheat (*Fagopyrum esculentum* Moench) companion plantings impact natural enemy abundance, and pest suppression in adjacent crops, may provide alternative control methods thereby slowing the rate of insect resistance to pesticides and reducing pesticide exposure to the applicator and surrounding habitats. Buckwheat has been widely used as a companion planting on vegetable farms, vineyards, and orchards to supply nectar and pollen and encourage arthropod natural enemy populations. However, scientific data demonstrating the true biological control benefit of such companion plantings are scarce. The primary objective of this project was to determine the impact of buckwheat companion planting on lepidopteran pest abundance, parasitoids abundance, parasitism, and the predator and parasitoid communities in collards. Overall abundance of pest caterpillars did not vary with distance and imported cabbageworm was the most abundant species. Parasitism of imported cabbageworm larvae did not differ with distance from available nectar sources. Abundance of parasitoids was not significantly different with distance, and the average rate of parasitism was 50%. Even at low numbers, it is likely that parasitoids play an important role in lepidopteran population dynamics. It also appears, however, that generalist predators may also be playing an important role. Future research will investigate the biology, habitat use, and predation impacts of some of these predators.

MONOSEX CULTURE OF FRESHWATER SHRIMP (*Macrobrachium rosenbergii*). Brian Nerrie, Virginia Cooperative Extension, Virginia State Univ., Petersburg VA 23806. In Virginia sustainable production of freshwater shrimp (*Macrobrachium rosenbergii*) has been shown to be an excellent agriculture diversification in the tobacco growing region, especially for limited-size farms. Research and demonstrated farming success in Israel, India and Bangladesh indicated improved yields for all-male shrimp populations. Research in Mississippi and Kentucky confirmed higher yields. Benefits and disadvantages of all-male or all-female monosex populations are discussed. Adoption of all-male production practices in Virginia would result in enhanced per acre production levels and larger individual animal size. However, multiple factors need to be considered by the private sector. The factors impacting on profits are: availability of all-male juveniles, stress from time and distance to stocking, survival rate, higher juvenile costs and whether consumer preference for higher prices for larger shrimp exceeds a larger quantity of smaller shrimp of the same value. Profitability will be the major determinant if monosex culture is adopted.

DISEASES OF CHANNEL CATFISH REARED IN CAGES IN VIRGINIA. David Crosby, Virginia Cooperative Extension, Virginia State University, PO Box 9081, Petersburg, VA 23806. The main production method for growing catfish in Virginia

is using cages in farm ponds. Most catfish fingerlings used for stocking cages comes from out of state commercial farms. After the initial stocking, parasitic and bacterial outbreaks can occur up to three days later. *Aeromonas hydrophila* and *Flavobacterium columnare* are the most common bacterial pathogens that cage producers will encounter. These pathogens are quite common in the aquatic environment and are the leading causes of disease problems in cages. Columnaris infections can occur within one day after stocking catfish into cages. A highly pathogenic strain of *Aeromonas hydrophila* that originated in Alabama has been diagnosed from catfish stocked in cages in Virginia. A study conducted at Virginia State University (VSU) found that catfish fingerlings imported from commercial farms usually had external parasites. *Trichodina* was found on catfish from four of the six commercial catfish fingerling shipments to VSU from 2007 – 2009. All shipments had *Henneguya*, the causative agent of proliferative gill disease. *Trichodina* is the most common parasite on catfish in cages that causes mortalities. In February of 2013, winter saprolegniasis or winter kill occurred in a caged catfish operation resulting in the high mortalities. This incident occurred in a pond with very low alkalinity, less than 17 ppm. Anytime a fish farmer is stocking catfish into cages from a commercial fish farm may increase the potential risk of a disease outbreak.

CAN STANDARD SOIL TESTS PREDICT ORGANIC BLUEBERRY PRODUCTION IN PLOTS WITH DIFFERENT SOIL AMENDMENT TREATMENTS? Roman J. Miller. Dept. of Biol. Eastern Mennonite University, Harrisonburg, Virginia 22802. What best predicts blueberry productivity: Soil tests? Foliar analysis? Plant growth? This question was examined in four blueberry plots with different mulches incorporated into their soil: organic horse manure (OHM), organic sheep manure (OSM), organic pine straw (OPS), and organic Planter Choice (OPC). Soil tests revealed normal or high nutrient levels in all plots. pH values were near optimal in OHM and OPC, but too high in OSM and too low in OPS. Soil respiration, foliar nutrient and chlorophyll values were within expected ranges or optimal in all plots. Growth parameters such as bushiness for Duke was greatest in OPS; while Bluecrop bushiness was greatest in OSM. Average plant height for OPS and OPC bushes was 50% greater than OSM bushes and 100% greater than OHM bushes. Berry productivity in the OPS and OPC plots doubled the OSM plot and exceeded the OHM plot threefold! While soil profiles and foliar analysis both failed to adequately predict berry productivity, simple bush height in unpruned young blueberry bushes emerged as the single best predictor of blueberry productivity. (Supported by USDA Specialty Crop Grant #2011-546)

#### Posters

ANALYSIS OF ANTHOCYANINS AND TOTAL PHENOLIC COMPOUNDS IN BLUEBERRIES: METHOD DEVELOPMENT AND PRELIMINARY RESULTS. A. Kniss, E. Harnish, S. Cessna & R. Miller, Departments of Biology and Chemistry, Eastern Mennonite University, Harrisonburg, VA 22802. Anthocyanidins and other phenolic compounds are known to have antioxidant capacity. Blueberries have been reported to be one of the richest sources of antioxidants among common fresh fruits. Interest in the micronutrients of blueberries has grown with increasing evidence of

possible health benefits. In order to compare the antioxidant profile of different varieties of high bush blueberries growing in differing conditions, several methodologies were tested. We found that two different UV-Visible spectroscopy-based measures of antioxidants were manageable for testing large numbers of berries. These are the FRAP assay (ferric ion reducing antioxidant power) and the Folin-Ciocalteu assay of total phenolic compounds. Our initial findings with these two assays indicate that Duke and Jersey varieties are lower in antioxidants than Blue Crop and Blue Gold. Several methods for HPLC quantification of acid hydrolyzed anthocyanidins were also tested; here we report the most successful extraction, hydrolysis and chromatography method. These three measures provide quantitative analysis of antioxidants in blueberry cultivars. Each method was developed to the point of functional use, and will be used to determine health of organically grown blueberries and compare them to conventionally grown blueberries. (Supported by USDA Specialty Crop Grant #2011-546)

ABUNDANCE OF APPETITE REGULATORY FACTOR mRNA IS INFLUENCED BY 3-HOUR FEED WITHDRAWAL IN CHICKENS SELECTED FOR HIGH AND LOW BODY WEIGHT. W. Zhang, L. A. Nelson, P. B. Siegel, M. A. Cline, & E. R. Gilbert, Department of Animal and Poultry Sciences, Virginia Tech, Blacksburg, VA 24061. Long-term (55+ generations) selection for low (LWS) and high (HWS) body weight in chickens has resulted in a 10-fold difference in body weight at selection age and correlated responses in appetite and body composition. Some of the LWS are anorexic, while HWS are hyperphagic and obese. We hypothesized that differences in appetite regulatory factor mRNA between the lines would be accentuated by food withdrawal. Five-day old male LWS and HWS chicks (n=24) were randomly divided into 2 treatments; 1) continuous access to a starter diet or 2) 3 h feed withdrawal, after which hypothalamus was collected. The mRNA abundance of *AGRP*, *NPY*, *NPYR1*, *MC4*, *GLUT1*, and *FOXO1* was measured by real time PCR. Data were analyzed by ANOVA using the Glimmix procedure (SAS 9.3). For *AGRP*, *NPY* and *NPYR1*, there was greater ( $P < 0.05$ ) abundance in LWS than HWS, whereas for *FOXO1* and *MC4* there was greater ( $P < 0.05$ ) expression in HWS. Food withdrawal affected hypothalamic *NPY* mRNA abundance, where *NPY* mRNA was greater in fed LWS chicks as compared with fed HWS ( $P < 0.05$ ) and fasted LWS chicks ( $P < 0.05$ ). In conclusion, there was greater mRNA abundance of food intake-stimulatory factors in LWS and greater abundance of satiety-inducing factors in HWS. These results suggest that differences in food intake between LWS and HWS are associated with differences in the appetite circuitry of the hypothalamus and that these differences are accentuated under certain feeding conditions.

### Astronomy, Mathematics, and Physics

AN INEXPENSIVE RADIO TELESCOPE IN A COLLEGE PHYSICS LAB, AN UPDATE. C. Crook & T.C. Mosca III, Dept. of Chem. and Phys., & Dept. of Math, Rappahannock Community College, Warsaw VA 22572. An amateur radiotelescope on the Glens campus of Rappahannock Community College was used by first-year physics students to conduct original research on solar radio frequency emissions. Most