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Oral Presentations

Analysis of morphology of Neotropical Geometrinae (Lepidoptera: Geometridae) using exo- and endoskeletal characters. D. Plotkin

The Geometrinae are commonly distinguished from other subfamilies of Geometridae using genitalic characters, wing venation, and scale patterns. However, removing scales from whole bodies of Geometrinae enables observation of further morphological variation of exoskeletal and endoskeletal characters. Using the method of Lee and Brown (2006), whole body mounts of descaled specimens of Neotropical Geometrinae were prepared. These were compared with whole body mounts of representatives from five other subfamilies of Geometridae. Variation of characters on the descaled head, thoracic segments, and tegulae was observed between subfamilies, indicating that these characters may be of diagnostic value. Further morphological variation was observed within Geometrinae, at the generic level. One character in particular, the length of the foretibial epiphysis AKA antennal comb, appears to be directly correlated with length of antennal pectination, implying functional variation.

Development of a Plant Based Threshold for Tarnished Plant Bugs in Cotton. A. Whalen**,** J. Gore, A. Catchot, F. Musser, J. Greene, B. R. Leonard, D. R. Cook, G. L. Snodgrass, and R. Jackson

The tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), is a pest of cotton, *Gossypium hirsutum* L., in the midsouthern United States. It is controlled exclusively with foliar insecticide applications. Sampling methods and thresholds need to be reevaluated. The current experiment was designed to establish a plant-based threshold to be used during the flowering period of cotton development when cotton can be difficult to sample using other techniques. Experiments were conducted in Mississippi in 2005 and 2006 and in Arkansas in 2005. Treatments consisted of various combinations of thresholds based on the percentage of dirty squares that were compared to the current threshold with a drop cloth or automatic weekly applications. Dirty squares were characterized as those that had been stained yellow from the excrement of feeding tarnished plant bugs. Treatments consisted of 5, 10, 20, and 30% dirty squares. Each plot was sampled weekly, and insecticides were applied when the mean of all replications of a particular treatment reached the designated threshold. At the end of the season, plots were harvested and lint yields were recorded. Differences were observed in the number of applications and yields among the different treatments. The 10% dirty squares threshold resulted in a similar economic return compared to the drop cloth. A threshold of 10% dirty squares resulted in a similar number of insecticide applications, yields, and economic returns compared to that observed with the drop cloth. These results suggest that a threshold of 10% dirty squares could be used to trigger insecticide applications targeting tarnished plant bugs in flowering cotton.

Impact of Water Management on Seed Treatments in Rice. A. Adams, J. Gore, D. Cook, G. Awuni, F. Musser

Two field trials were conducted to determine the impact of water management on the efficacy of insecticide seed treatments against rice water weevil, *Lissorhoptrus oryzophilus* Kuschel, in rice at the Delta Research and Extension Center during 2011 and 2012. The performance of thiamethoxam, chlorantraniliprole, and clothianidin was evaluated when the permanent flood was established at different timings (6 and 8 weeks after planting) and the effect of flush number (0, 1, or 2) on seed treatment performance was evaluated. Seed treatment efficacy was not impacted by delayed flooding, but 2 flushes reduced efficacy of some seed treatments.

Cross-Pollination between Bt Corn and Non-Bt Refuge: Effects on Corn Earworm Resistance Development. A. Babu, M. Caprio, D. Cook, C. Allen, and F. Musser.

Impact of cross-pollination between Bt corn plants and non-Bt refuge plants on growth and survival of corn earworm, *Helicoverpa zea* (Boddie), were tested. A pyramided Bt hybrid (DKC 67-88) and its non-Bt near isoline (DKC 67-86) were used as parent plants. Four different corn crosses namely Bt X Bt, Bt X non-Bt, non-Bt X Bt, and non-Bt X non-Bt were carried out during the summer of 2011 and 2012 at R. R. Foil Plant Science Research Farm in Starkville, MS. Four days after cross-pollination, all hand pollinated ears were inoculated with one day old corn earworm larvae. Approximately 25 larvae per ear were dispensed on to silks, and growth and survival of corn earworm were recorded, 10 day after larval inoculation. In both 2011 and 2012, larval growth and survivorship was significantly lower on Bt maternal plants than that of non-Bt maternal plants. When non-Bt refuge ears were pollinated by the pollen from Bt parents, both larval survivorship and growth were significantly reduced than that of non-Bt X non-Bt cross during 2011 and a similar trend was observed in 2012. Overall results indicate that cross-pollination of non-Bt refuge ears from nearby Bt plants could significantly decrease the corn earworm growth and development, reducing its quality as refuge.

Impact of Corn Earworm on Field Corn Yield. J. Bibb, A. Catchot, D. Cook, F. Musser, S. Stewart, B. R. Leonard[4], T. Allen, and D. Buntin

Recently field corn, *Zea mays L.,* with new pyramided *Bacillus thuringiensis* (Bt) corn technologies has been introduced to the market. These technologies reduce kernel damage from ear feeding caterpillar pests, including corn earworm, *Helicoverpa zea* (Boddie), and fall armyworm, *Spodoptera frugiperda* (J.E. Smith). The first generation Bt traits in field corn demonstrated very little activity on corn earworm feeding on grain in ears. The new pyramided corn technologies have, higher cumulative protein levels, and improved expression throughout the plant these new corn traits should provide an effective management tool against these pests. In addition, reduced kernel injury should also have a direct effect on physical grain quality and potentially yield protection. Thus, it is important to quantify the level of injury and yield impacts caused by ear feeding lepidopteran insect pests, specifically corn earworm. These results could provide significant new information and opportunities to improve IPM of field corn across the southern U.S.

These studies were conducted at four locations during 2011 and 2012 that included R. R. Foil Plant Science Farm, Starkville, MS; Delta Research & Extension Center, Stoneville, MS, West Tennessee Experiment Station, Jackson, TN, and Macon Ridge Research Station, Winnsboro, LA. Plot size was 8 rows (row spacing) by 30-50 ft.). Treatments included field corn hybrids expressing the Herculex 1, VT3, and VT Triple Pro technologies. Treatments were arranged in a randomized complete block design with four replications. Multiple plantings were utilized at each location to increase the

probability of encountering corn earworm infestations of different intensities. Damaged kernels were significantly decreased by insecticidal applications. Test weight was found to be significantly increased by insecticidal applications, but only in Herculex. No significant relationship between number of damaged kernels and grain yield was observed.

Impact of Simulated Sugarcane Beetle (Euetheola humilis rugiceps) Feeding in Field Corn. K. Lanford, A. Catchot, D. Cook, F. Musser, and E. Larson

The sugarcane beetle (Euetheola humilis) has become a major problem in field corn in the hill region of Mississippi and the southeastern United States. This pest of seedling corn is extremely destructive and difficult to control. Sugarcane beetle adults will damage corn by chewing into the subterranean portion of the plant, killing small seedlings and stunting large plants. Producers in the hill region of Mississippi have commonly experienced 10-40% stand reduction from sugarcane beetles with no available rescue treatments. It is often difficult to assess yield loss from sugarcane beetle injury since not all injured plants die in the field. Some are damaged to the point that they will not produce seed, but they still survive and essentially become a weed competing for nutrients. The problem producers face is that damage is often not observed when it occurs, but is found later in the season when replanting in no longer an option. Even when damage is observed early, it is difficult to predict yield loss and determine if replants are necessary or worthwhile given that replanting may occur after optimal planting dates for field corn. This study is intended to give producers a better understanding of their situation when dealing with an infestation of sugarcane beetles. Eight rows were planted at 40 feet. At the V4 growth stage, a 5/16 drill bit was used to damage the seedling corn plants just below the soil surface. A half turn of the 5/16 drill bit resulted in damage that was almost identical to sugarcane beetle feeding in normal field conditions. Every fifth plant was damaged and marked for further observation. Seven days after injuring the plants ratings were taken using a rating scale developed based on symptomology of the plant. The rating scale ranged from 0 to 3 depending on the level of symptomology with 0 being the least and 3 being the most severe. The rating scale used is as follows: 0 for no visible symptomology, 1 was given for slight yellow streaking in leaves, 2 is for heavy streaking and/or stunting, and 3 was given to “suckering” plants or plants with dead-heart. Ratings were taken every seven days until the plants reached the tassel stage but for this study only the week one ratings were analyzed. The injured plants, along with the two adjacent plants, were hand harvested. Ear length was taken of each ear and the ears were hand shelled and kernel weight for each ear was recorded.

The observations were divided by the initial rating that each ear received. The N represents all plants that were not damaged. Each group showed significant difference in ear length. There were significant differences in kernel weight up to the 2 and 3 rating. The results indicate that any feeding by a sugarcane beetle, regardless of severity, will result in yield loss and that symptomology can be an indicator of how severe that loss will be. Other studies are underway to determine what this means in a field situation along with ways to prevent a sugarcane beetle infestations.

Polygalacturonase gene expression in field collected *Lygus lineolaris.* D.E. Fleming, N. Krishnan, and F.R. Musser

Synopsis: Differences in polygalacturonase gene expression between Delta and Hills population of tarnished plant bugs collected from cotton, horseweed, and pigweed. Polygalacturonase (PG) enzymes in the salivary glands of *Lygus* spp. have been shown to breakdown plant pectin to allow for easier plant tissue uptake and possible oviposition site preparation. However, there is a paucity of information about their expression in

geographically distinct populations as well as regulation at the transcriptional level on different host plants. *Lygus lineolaris* adults were collected from cotton, horseweed, and pigweed from the Delta and Hills regions of Mississippi. Quantitative real time-polymerase chain reaction (qRT-PCR) was used to measure expression levels of three PG genes (PG1, PG2, PG3). The data indicated differences between the regions, host plants, and the PG genes. *L. lineolaris* collected from cotton in the Delta expressed PG1, PG2, and PG3 lower than those collected from pigweed or horseweed. *L. lineolaris* collected from cotton and horseweed in the Delta also expressed lower levels of PG3 than PG2, while those collected from pigweed expressed higher levels of PG1 than PG2. *L. lineolaris* collected from cotton in the Hills showed higher expression of PG1 than those collected from horseweed and pigweed and those collected from horseweed expressed lower levels of PG3 than those collected from cotton or pigweed. L. lineolaris from cotton in the Hills expressed PG1 higher than PG2 or PG3 on and those collected from horseweed and pigweed expressed PG3 lower than PG1 or PG2. Taken together, this data indicates that some genetic differences in PG expression exists between the two populations (Delta and Hills) of *L. lineolaris* in Mississippi and is its regulation is also affected by host plant.

Impact of *Oebalus. pugnax* (F.) (Hemiptera: Pentatomidae) Infestation Timing on Rice Yields. G. Awuni, J. Gore, D. Cook, A. Adams, F. Musser

Two field cage experiments were conducted during 2010 and 2011 at Stoneville, MS to evaluate the impact of adult rice stink bug, *Oebalus pugnax* (F.), on two rice cultivars ('Cocodrie' and 'Wells') at bloom, milk, and soft dough stages of panicle development. One experiment used sleeve cages in a completely randomized design with 20 replications over individual rice panicles, while the other experiment had four replications with large cages covering multiple rice panicles in a randomized complete block design. Insect densities included 1 or 2 *O. pugnax* on individual panicles and 11 or 22 *O. pugnax* per m^2 over multiple rice panicles per cage. Caged un-infested controls were included in each experiment. Rough rice yield and percentage of undamaged damaged kernels and blank kernels were evaluated at the end of the season. In both experiments, consistent results were obtained for percentage of damaged kernels and percentage of blank kernels for stage of panicle infestation timing. Mean percentage of undamaged kernels was lower and mean percentage of blank kernels was greater when rice was infested during the bloom stage, while the mean percentage of damaged kernels was greater when rice was infested during the milk stage. *O. pugnax* infestations during bloom and milk stages reduced yield. These trends indicated that the bloom and milk stages are the most critical stages for *O. pugnax* injury.

A Comparison of Tarnished Plant Bug Populations from Two Regions in Mississippi, B. Adams, A. Catchot, D. Cook, J. Gore

A laboratory experiment was performed to compare fitness parameters of tarnished plant bug populations collected from the Hills and Delta regions of Mississippi. Each population was split into two cohorts to be reared on cotton or artificial diet to make comparisons of food source as well as region of collection. Data were analyzed using analysis of variance and regression analysis. Populations were collected from pigweed, *Amaranthus* spp., in four locations in each region. Each population was maintained separately and allowed to mate. Progeny from the F1 generation of each population were compared from each region and food source. Parameters measured included development times to fourth instar, fifth instar and adult, total nymphal survivorship, fecundity, and fertility. Populations collected from the Delta region and reared on cotton developed significantly faster to all life stages than other populations while populations from the Hills reared on cotton were significantly slower than other populations except Hills populations reared on artificial diet. There were no significant differences for

percent survivorship for region of collection; however, populations on diet had significantly higher survivorship than those reared on cotton. Populations of tarnished plant bug from the Delta region laid significantly more eggs per female per day than populations from the Hills region. Populations reared on cotton also laid significantly more eggs per female per day than those reared on diet. Populations collected in the Delta region laid significantly more viable eggs per female per day than those from the Hills region. Populations reared on cotton produced significantly more nymphs per female per day than those reared on diet. There were no significant differences in mean percent hatch of total eggs laid for region or food source. These data indicate there are differences in several fitness parameters between tarnished plant bug populations from the Hills and Delta regions of Mississippi.

Susceptibility of Cotton Bollworm, *Helicoverpa zea*, collected from Genuity VT3 PRO Field Corn on Dual-Gene Transgenic Cotton. B. Von Kanel, A. Catchot, J. Gore, F. Musser, R. Jackson

Bollworm larvae were collected from Non-Bt and VT3P field corn. Larvae were evaluated on fitness costs of pupal duration and pupal weight. Reciprocal crosses were arranged to determine dose mortality curves for neonate larvae on lyophilized Bollgard II cotton. Male bollworm larvae collected from VT3P had a longer pupal duration compared to males collected from Non-Bt. Female pupal duration did not significantly differ. All larvae collected from VT3P had higher pupal weights than larvae collected from Non-Bt. Progeny from females reared on VT3P had higher LC50 values compared to progeny resulting from females reared on Non-Bt regardless of paternal host.

Insect Succession on a Human Analog, for North Central Mississippi. J. Seltzer and J. Goddard

In the spring of 2012 an adult pig was placed at South Farm, on Mississippi State University, as part of the Forensic Entomology class taught by Dr. Jerome Goddard. The pig was placed for the students to learn the successional patterns of insects as part of the decomposition process. Students were placed into teams and were instructed to collect the forensically important insects on a daily basis, to confirm the pattern of succession for the agricultural setting. However, when the collection data was analyzed what appeared to be a perfect successional pattern was actually spikes and drops in insect collecting, brought about by the variation in skill and training of the students working on the project. Peaks were created by the collection events of the entomology graduate student and the undergraduates, lacking entomology experience, generated lows. This demonstrates the need for proper training and experience in forensic entomology.

Studies on the supercooling point of the female redbay ambrosia beetle (*Xyleborus glabratus*) - implications for invasion potential in the northern latitudes of North America. J. P. Formby, N. Krishnan[1], and J. J. Riggins

The redbay ambrosia beetle, *Xyleborus glabratus* Eichoff, (Coleoptera: Curculionidae: Scolytinae) is an invasive pest of North America trees and shrubs in the family Lauraceae. The beetle vectors the fungal pathogen, *Raffaelea lauricola*, the causative agent of Laurel Wilt Disease (LWD), a disease lethal to millions of our native trees. To begin to characterize the North American invasion potential of *X. glabratus*, the supercooling point (SCP) was experimentally determined on field-collected and artificially cold hardened specimens. Field-collected beetles were trapped using Lindgren funnel traps baited with manuka oil lures. Testing was performed June through August 2011. Specimens obtained for cold hardening were reared from symptomatic redbay (*Persea borbonia*) bolts and cold hardened in a low temperature incubator for ~1 month. Field-collected and cold hardened *X. glabratus* supercooled to a mean (±SE) temperature of -

21.7ºC ±0.5ºC and -23.9ºC ±0.4ºC, respectively. Artificial cold hardening significantly lowered the SCPs with respect to field-collected beetle SCPs. Beetle size and weight had no effect on the SCPs of tested beetles. Based on the mean SCPs*, X. glabratus* and LWD could theoretically impact Lauraceae throughout North America. However, supercooling data alone are not enough to adequately predict the invasion potential of *X. glabratus*, i.e. significant mortality is likely at warmer temperatures. Ongoing cold hardiness studies and biochemical analyses will offer improved estimates on the sub-lethal effects of low temperature and the invasion potential of *X. glabratus* into northern forests of North America.

Poster Presentations

Impact of Corn Earworm on Field Corn Grain Quality. J. Bibb, A. Catchot, D. Cook, F. Musser, S. Stewart, B. R. Leonard, T. Allen, and D. Buntin

Recently field corn, *Zea mays L.,* with new pyramided *Bacillus thuringiensis* (Bt) corn technologies has been introduced to the market. These technologies reduce kernel damage from ear feeding caterpillar pests, including corn earworm, *Helicoverpa zea* (Boddie), and fall armyworm, *Spodoptera frugiperda* (J.E. Smith). The first generation Bt traits in field corn demonstrated very little activity on corn earworm feeding on grain in ears. The new pyramided corn technologies have, higher cumulative protein levels, and improved expression throughout the plant these new corn traits should provide an effective management tool against these pests. In addition, reduced kernel injury should also have a direct effect on physical grain quality. Thus, it is important to quantify the level of injury and grain quality impacts caused by ear feeding lepidopteran insect pests, specifically corn earworm. These results could provide significant new information and opportunities to improve IPM of field corn across the southern U.S.

These studies were conducted at four locations during 2011 and 2012 that included R. R. Foil Plant Science Farm, Starkville, MS; Delta Research & Extension Center, Stoneville, MS, West Tennessee Experiment Station, Jackson, TN, and Macon Ridge Research Station, Winnsboro, LA. Plot size was 8 rows (row spacing) by 30-50 ft.). Treatments included field corn hybrids expressing the Herculex 1, VT3, and VT Triple Pro technologies. Treatments were arranged in a randomized complete block design with four replications. Multiple plantings were utilized at each location to increase the probability of encountering corn earworm infestations of different intensities. Test weight was found to be significantly increased by insecticidal applications, but only in Herculex. Within technologies, insecticidal applications did result in significant decrease of kernel damage, but did not result in significant differences of aflatoxin levels.

Efficacy of Insecticide See Treatments on Hybrid Rice. A. Adams, J. Gore, D. Cook, G. Awuni, F. Musser.

Experiments were also conducted to determine the impact of reduced seeding rates found in hybrid rice production on the efficacy of insecticide seed treatments targeting rice water weevil. Efficacy was similar when comparing currently labeled rates of thiamethoxam, chlorantraniliprole, and clothianidin with higher rates of these products.

Seasonal Abundance and Phenology of Rice Stink Bug, *Oebalus pugnax* (F.) to Graminaceous Host Species in Mississippi. G. Awuni, J. Gore, D. Cook, A. Adams, F. Musser

Field surveys of rice stink bug, *Oebalus pugnax* (F.) populations were conducted on numerous host grasses species in Washington, Bolivar and Sunflower counties in Mississippi. Sampling was initiated on 4 May to 18 August of 2011, and from 12 April to 15 August of 2012. Cultivated and non-cultivated hosts were sampled with a 38 cm

diameter sweep net. One hundred sweeps were sampled on each host at each location. The number of rice stink bug adults and nymphs per 10 sweeps was a sample. A total fifteen principal host grass species were identified in both years. Overall population densities of rice stink bugs were lower in 2012 than 2011. Ryegrass was the most common host grass species from winter and served as an early breeding host of rice stink bug into summer. During summer as well as in fall, *Digitaria* spp. (crabgrass), *Echinochloa* (Jungle rice), *Eriochloa* spp. (Prairie cupgrass, and southwestern cupgrass), *Paspalum* spp. (dallisgrass, and Bahiagrass), and *Sorghum* (Johnsongrass) were the most abundant host grass species that supported adult and nymphal development of *O. pugnax*.). Host switch was critical for the survival and development of *O. pugnax* because reproductive structures of host grass species fed on by rice stink bug were temporal. The abundance of glyhosate-resistant Italian ryegrass in the central Mississippi Delta appeared to play a significant role in the abundance and dynamics of rice stink bug population. Italian ryegrass was the site for early feeding and breeding for rice stink bugs until other host grass species began to flower and produce seeds. Measures aimed at disrupting this cycle such as timing control of host grasses could reduce rice stink bug population, thereby minimizing rice field infestation by this rice pest.

Preliminary data on the survival and development of *Lygus lineolaris* collected from the Delta and Hills regions of Mississippi. D. E. Fleming and F. R. Musser.

Synopsis: Differences in survival and development time of *L. lineolaris* reared on corn, cotton, soybeans, and diet. *Lygus lineolaris* feeds on most of the crops grown in Mississippi and has been the most important pest in Mississippi cotton for the past several years. Though polyphagous, they seem to preferentially feed and build large populations on a few crops and weed hosts. Recent research has shown that *L. lineolaris* from the Delta and Hills regions of Mississippi may respond differently to cotton. To further explore differences between these regions, four colonies of *L. lineolaris* from the Delta (2 colonies) and Hills (2 colonies) regions of Mississippi were used to compare survival and development times on corn, cotton, soybean, and artificial diet. Data indicate that there is little or no difference between the regions for either survival or development time. Over both regions, survival showed a trend of artificial diet > corn> cotton> soybean. The trend for overall development time indicated that development rate was slowest for *L. lineolaris* reared on corn and soybean and fastest on artificial diet and cotton. These preliminary data conflict with previous data and suggest that *L. lineolaris* populations in different regions of Mississippi may not be different after all; however food source does affect survival and development time of *L. lineolaris* from both the Delta and Hills regions of Mississippi.

Results from the Regional Identification Center of the USDA-APHIS (Eastern Region) for the 2012 Wood Boring Beetle Surveys, Including New State Records. J. Seltzer, T. Schiefer, and Ri. Brown

Since 2009 the Mississippi Entomological Museum (MEM) has served as a Screening and Identification Center for the USDA-APHIS Eastern Region. We currently support Cooperative Agricultural Pest Surveys in Mississippi, Alabama, and Kentucky for exotic wood borers/bark beetles, Sirex Woodwasps, and a wide range of Lepidoptera Pests. A total of 3189 samples were received for screening and identification between January 1, 2012 and October 15, 2012. This is an increase over last years figure of 1624 Lindgren funnel trap samples. This increase has directly impacted the number of samples we have identified as being positive for presence of an exotic species. A total of 32 positive specimens were identified from 20 samples, up from 15 positive specimens in eight samples in 2011. Nine of ten positive samples in Alabama were positive for Ambrosiodmus minor (Stebbing) a new state record. A. minor, was present in samples from Geneva, Conecuh, Houston, Montgomery, and Monroe Counties. The second State

record for Alabama, Geneva County, is a single specimen identified as Ambrosiodmus sp. prob. lewisi Blanford. Mississippi samples produced two new state records. Xyleborinus octiesdentatus (Murayama) from Forrest, Lamar and Perry Counties. Xylosocus capucinus (Fabicious), an exotic bostrichid, is the second state record for Mississippi, from Hancock County.

The Gravid Trap Attractants Project. W. H. Dees and Matthew M. Yates

Mosquito control programs continually investigate better ways to collect mosquitoes for general surveillance and virus isolation. The gravid mosquito trap is one such collection method. Gravid traps have a standard oviposition pan on which the trap is placed. The oviposition pan contains water and attractant formulations that attract ovipositing mosquitoes to the trap. We present gravid trap attractant formulations used in the oviposition pan. The formulations we present are used by different parish/regional mosquito control programs in Louisiana. Many formulations used in oviposition traps use fish oil as an additive, while others use hay infusion. The standard rate for fish oil is approximately 60 ml (2 fl oz) fish oil/3.8 L (1 gal) water. Hay infusion contains hay, lactalbumin, liver powder and yeast. Sometimes additives, such as alfalfa pellets or grass clippings, are used to enhance the attractiveness of the solution to ovipositing mosquitoes. Experiments to determine gravid trap attractant formulations have a practical, real-world utility. Persons who test different formulations of gravid trap attractants for collecting mosquitoes or who use gravid traps for collecting mosquitoes are encouraged to submit their gravid trap attractant formulations to the Gravid Trap Attractants Project (GTAP). One of the goals of GTAP is to compile and disseminate gravid trap attractant formulations to the operational mosquito control community.

Mosquitoes and Botanical Extracts. W. H. Dees, J. T. Guidry, K. A. Helo, I. J. Louque, S. Pradhan, O. E. Christian, C. Richmon and J. Hightower

We evaluated the effects of plant extracts on mosquito oviposition preference and egg/larval survival. The organic extracts of plants and plant leaves, roots or fruit of *Artocarpus communis*, *Clusia rosea*, *Coccoloba* sp., *Datura* sp., *Hibiscus sabdariffa*, *Hypericum brachyphyllum*, and *Hypericum hypericoides* were evaluated against *Aedes aegypti* mosquitoes. Crude methanolic or ethyl acetate botanical extracts were added to distilled water and tested against mosquitoes. In oviposition experiments, we determined the oviposition activity index (OAI) for each extract. Oviposition activity indices range from 1 (attraction) to -1 (repellency). A zero denotes no preference to the extract. *Clusia rosea* leaves extracted in ethyl acetate slightly attracted ovipositing mosquitoes (OAI = +0.06). Ethyl acetate leaf and root extracts of *Hibiscus sabdariffa* and methanolic fruit extracts of *Coccoloba* sp. showed slight repellency (OAI = -0.06, -0.13, -0.26, respectively). Ethyl acetate extracts of *Hypericum hypericoides* and methanolic extracts of all plant parts of *Clusia rosea, Hibiscus sabdariffa and Hypericum hypericoides* strongly repelled ovipositing mosquitoes (OAI range: -0.42 to -0.67). In experiments on egg eclosion, mosquito larvae emerged earlier and in greater numbers in water with extracts when compared with controls. More larvae emerged from eggs placed in solutions of *Hibiscus sabdariffa* and *Datura* sp. extracts than from any other solutions. Mortality was observed in two of the seven tested extract solutions (methanolic leaf and root extracts of *Hypericum brachyphyllum*). No mortality was observed in the controls. Since nutrients were provided to all eggs/larvae, further investigations of other chemicals influencing egg eclosion are warranted.

Biometeorology and Mosquito-borne Disease Models. W. H. Dees and L. D. Canning

For more than five years, we have conducted long-term studies of nocturnally active mosquitoes in the Sabine National Wildlife Refuge (a salt/brackish/intermediate freshwater marsh) and in Moss Bluff (a freshwater marsh) in southwest Louisiana. These investigations are still underway. These studies involve collecting mosquitoes before, during and after sunset and sunrise, and throughout the night using Centers for Disease Control mosquito light traps. Traps are placed 1.5 m above ground, in areas with little to no competing light. Mosquito genera collected include *Aedes*, *Anopheles*, *Coquillettidia*, *Culex*, *Culiseta*, *Psorophora* and *Uranotaenia*. Meteorological conditions, specifically humidity and temperature, are recorded when mosquitoes are collected. To date, mosquito species have been collected during times of both low and high relative humidity (23-95+% RH). On a given trap night, average relative humidity ranged between 54-95+% RH. Different humidity ranges may affect the presence of different mosquito species. Temperature showed greater effect on the distribution of species than humidity. Mosquitoes were collected when average nightly temperatures on a given trap night ranged between 8.8°C (low -1.5°C) and 31.4°C (high 38.9°C). No mosquitoes were collected when average temperatures were at or below 8.1°C on a given trap night. *Culex* spp. and *Culiseta* spp. were more prevalent at lower temperatures while *Aedes* spp. (except *Aedes canadensis*), *Coquillettidia* spp., *Psorophora* spp. and *Uranotaenia* spp. were more prevalent at higher temperatures. Biometeorological information obtained through long-term investigations such as this study can be useful in modeling risks associated with mosquito-borne diseases and pestiferous mosquito species.

Colony structure and spatial partitioning of cavity dwelling ant species in nuts of eastern US forest floors. D. Booher, J. A. MacGown, and R. M. Duffield

Nut-bearing trees create islands of high efficiency, low cost housing opportunities for ant colonies. Fallen nuts in leaf litter from previous seasons provide ready-made nest sites for cavity dwelling ant species, as well as affording protection from the elements. Suitable nuts for nests require an entrance of some type, which may be a simple crack in the shell, or in many cases an emergence hole created by late instar coleopteran and lepidopteran larvae known to consume the protein rich nut. With over 30 species of southeastern hickories, pecans, chestnuts, walnuts, and oaks; large numbers of suitable nut cavities created by insect feeding; and variation in intraspecific and interspecific nut productivity and nut size; the possible variations of potential nut nesting sites are extensive. A dearth of information is available on colony structure, environmental parameters affecting choices for suitable nest selection sites, negative effects of restricted colony sizes to confined sizes of nuts, and spatial partitioning for nut/cavity inhabiting ant species. Our study aims to answer these basic questions. We collected potential nut-nests from various nut bearing tree species in Maryland, Mississippi, and Georgia. We identified and defined individual trees as a site, took environmental measurements to compare sites, and collected nuts at each site.

Evidence for Reduced Genetic Variation in US Populations of Black Imported Fire Ant D. C. Cross and M. A. Caprio

The black imported fire ant (BIFA or *Solenopsis richteri*) range includes about 12-15 counties in western TN and the NE corner of MS. Isolated populations exist in AL and farther south in MS. Its genetic contribution, however, is more broadly represented (by more than six times the area) in the hybrid imported fire ant (HIFA) population. We used a Restriction Fragment Length Polymorphism (RFLP) technique to delineate mtDNA types in the imported fire ant (BIFA, the red imported fire ant - RIFA or *Solenopsis invicta*, and their hybrid - HIFA) for 308 colonies or recently mated queens or the sperm they possessed from seven southeastern states, TX and CA. By using an abbreviated form of a test originally designed for RIFA we were able to reliably distinguish BIFA mtDNA haplotypes from those of RIFA. Where we could identify 5 RIFA types, only one is

indicated for BIFA using this RFLP technique. To more precisely identify the single BIFA haplotype, we collected black imported fire ants from nine colonies in three counties in MS and five counties in TN and sequenced a 414 bp gene fragment within the same mtDNA genetic region. The sequence data also indicate the presence of a single BIFA mtDNA haplotype, verifying a much reduced mitochondrial genetic diversity when compared to RIFA. The haplotype we found associated with this species in the US matches a single type from southern Brazil. The linking of a source biotype (and presumably an indicator of its native range) may provide information useful for a more targeted development of biological control agents as well as provide information of ecological interest. Parasitoids or microbial agents chosen to control this particular biotype will likely have enhanced effectiveness not only for *S. richteri*, but also for the hybrid of the two species.

Preliminary Survey of Ants (Hymenoptera: Formicidae) and Grasshoppers (Orthoptera: Acrididae) of the Big Thicket Region of Texas. J. G. Hill

Located in southeast Texas, the Big Thicket region has been called " the biological crossroads of North America" as species from the east and west occur relatively near each other within a mosaic of habitats such as arid sandy lands, bottomland hardwood forests and cypress sloughs, palmetto hardwood flats, wetland pine savannah, upland pine forests, and mixed grass prairies. Several protected areas including the Big Thicket National Preserve and others owned and managed by the Nature Conservancy, the state of Texas, and several other entities can be found in the region. In 2006, an All Taxa Biodiversity Inventory (ATBI) began in the Thicket to document every living species within the region. As part of the ATBI, surveys of ants (Hymenoptera: Formicidae) and grasshoppers began in the Fall of 2011, and should continue for at least another year. During this first year of sampling, 38 ant species and 23 grasshopper species were documented across various habitats within the Big Thicket. The documentation of two ants, *Dolichoderus pustulatus* and *Strumigenys angulata* represent new state records for Texas. Additionally, six exotic ant species were documented in the region, with three species (*Brachymyrmex patagonicus*, *S. invicta*, and *Pheidole morens*) being extremely abundant, even in apparently undisturbed habitats.