**Minutes of annual meeting of multi-state project S-1060**

**Fly Management in Animal Agriculture Systems and Impacts on Animal Health and Food Safety**

# Orlando, FL, January 17-18, 2018

In attendance:

Alec Gerry UC Riverside

Erika Machtinger Penn State

Dana Johnson USDA, Gainesville, FL

Dana Nayduch USDA, Manhattan, KS

Heather Furlong USDA, Gainesville, FL

Emma Weeks University of Florida

Jessica Thomson Kansas State University

Jerry Zhu USDA, Lincoln, NE

Phil Kaufman University of Florida

Jamie Freeman Cornell University

Nancy Hinkle University of Georgia

Herb Bolton USDA-NIFA

John Stoffolano University of Massachusetts

Wes Watson North Carolina State

Ludek Zurek Kansas State University

Phillip Shultz Texas A & M

Lettie McKay University of Tennessee

Travis Davis University of Tennessee

Jerry Hogsette USDA, Gainesville, FL

Brandon Smythe New Mexico State University

Doug Ross Control Solutions, Inc

Bill Donahue Sierra Research Laboratories

Chris Geden USDA, Gainesville, FL

Becky Trout Fryxell University of Tennessee

Gary Brewer University of Nebraska

Rick Roeder University of Arkansas

Dave Boxler UNL, North Platte, NE

David Taylor USDA, Lincoln, NE

**Opening session:** Acting chair Alec Gerry called the meeting to order. Project chair Kristina Friesen has announced her decision to retire from USDA, effective Feb 24, but agreed to help complete the project re-write. Alec reminded the group that the annual report is due 60 days after the meeting and that the final report is due in 12 months. Local arrangements coordinator **Jerry Hogsette** provided information about the facility, wireless signal access, and registration. This was followed by a round of self-introductions.

**Rick Roeder**, the administrative advisor to S1060 reminded us that the annual report is due 60 days after the meeting, and that the current project ends on 9/30/2018. We should try to have a new project submitted by January 30. Because of the long time that it takes to complete the review, we may have to use a temporary project number for next year’s meeting.

**Herb Bolton** discussed the situation in Washington. The lack of a budget is slowing down the NIFA grants process. NIFA director Sonny Ramaswamy is advocating for funding “tactical science”, making the point that agricultural commodities have large impacts the country’s economy and need appropriate funding. Sonny had to fight to restore NIFA funding after sequestration. The Farm Bill is under development and may include some “tactical science” elements. NIFA is developing a new strategic plan. Our project submitted input on this during the comment period, as did MUVE and Nancy Hinkle. On the NIFA website, the “Data Gateway” is replacing the CRIS portal for searching for funded projects. The NIFA site now allows you to sign up for updates. You can also share your results via the “Share Your Science” tab under the “Impact” main tab of the NIFA site.

Herb mentioned that Sonny Ramaswamy is working hard to get capacity funds back and to increase AFRI funding, which is only funded at about 30% of what it should be. AFRI has two new programs. The first is CARE (Critical Agriculture Research and Extension), intended to fund very applied work that is ready for implementation and outreach. The second is “Exploratory”, for highly innovative breakthrough work across all commodities. AFRI also funds fellowships for young scientists on all topics through the ELI (Education and Literacy Initiative) program

**Objective 1**. **New technologies for management of biting and nuisance flies in organic and conventional systems**

* **Wes Watson** announced that NC State has filled four entomology faculty slots this year, including positions on precision pest management, systematics, and insect-vectored viruses. He then reported on a horn fly dispersal study in which he got as team of 14 students to help with a mark -release-recapture study where flies were monitored on a herd located 277 meters away after treating the cattle at the release site with 1% geraniol. In the first trial, geraniol was only applied to the upper body, and many of the flies simply moved to the legs rather than dispersing from the treated herd. Higher recapture rates (8%) were observed when whole-body treatments were made at the release point. His lab has developed a flight mill and found that horn flies flew 1.4-2.5 km/hr. They plan to expand this work to look at horn fly, stable fly, house fly, and face fly flight as a function of fly age, sex, feeding status, reproductive condition, etc.
* **Alec Gerry** summarized some push-pull work using geraniol and fatty acids (C8-9-10) as repellents. Both provided good immediate results but the repellency was transient, and flies seemed to be getting adequate blood meals even on treated animals. He then reported on bait test with house flies in which a new indoxycarb (sodium channel blocker) bait worked well when compared with the established commercial products Zyrox and QuickStrike. There were signs that the flies were becoming tolerant of the dinotefuron used in QuickStrike bait. Lastly, he presented work that his student Levon Zahn is doing using sensors to recognize and count flies. It can count flies using fluctuations in light transmission as they pass through a 3”-1 meter circle using photosensor arrays and a laser line. The sensors, in combination with the software involved, can “learn” to recognize species based on body size and wing beat signatures. The sensors are inexpensive but the software will be licensed and costly.
* **Jerry Zhu** discussed some new work on a repellent from coconut oil. He pointed out that although catnip oil is effective it is highly transient and only lasts for 6 hours or so in the field. Fatty acids and their methyl esters found in coconut oil look more promising, especially the C8 lauric acid and methyl laurate. C8-C13 fatty acids are repellent, but C14 upward are not. Lauric acid is safe and very inexpensive; it could be applied to cattle for $0.08 per animal. Repellency persists for up to two weeks in the lab and has activity against horn flies, bed bugs, and ticks. He is working with a 14% starch formulation that is particularly effective.
* **Dave Boxler** presented work on a number of topics related to horn fly control. 1) apple cider was expensive and ineffective; 2) New YTex tag with 6% abamectin, 3% cypermethrin and 20% PBO provided 70% control and was also effective against face flies; 3) Another YTex tag, the XP820 (8% abamectin and 20% PBO) provided excellent control for 10-12 weeks.
* **Chris Geden** gave a summary of work with Israeli scientists on pyrproxifen, some new work on sugar alcohols as a vehicle for *Beauveria bassiana*, and has a new student who will look at whether parasitoids can detect pupae that are infected with *B. bassiana*.
* **Erika Macthinger** outlined a grant with **Chris Geden** that was recently funded by U.S. Poultry and Egg. They will be searching for new strains of *B. bassiana* from flies collected in poultry houses, selecting to improve virulence, and testing for compatibility with parasitoids and predators.
* **Dana Johnson,** who has just finished her MS thesis, gave an overview of her research project. She looked at combinations of *Beauveria bassiana* with three gram-negative bacteria species. There was little evidence for synergy, but combinations of *B. bassiana* with *Pseudomonas protegens* were more effective than either pathogen alone and *P. protegens* has an exotoxin that looks promising in its own right.
* **Jerry Hogsette** found that by placing KnightStick fly traps inside a solar-powered electric fence enclosure within the animal exhibits at the National Zoo, the traps caught 3-10 times as many flies as traps that were placed along the perimeter of the exhibits.

**Objective 2.** **Insecticide resistance detection and management.**

**Jamie Freeman** from **Jeff Scott’s** lab is examining the frequency of several resistance alleles in house flies, including the VSSC mutations kdr, kdr-his, and s-kdr as well as the detoxification alleles in the CYP family. Kansas flies are highly resistant to permethrin (lots of s-kdr), Utah about 50% resistant, and New Mexico flies had low resistance. CYP6D1 was very common in all populations, especially Kansas. Tetrachlorvinphos resistance patterns were similar to permethrin. Kansas flies were 100% resistant to methomyl.

**Objective 3. Investigation of the microbial ecology, epithelial immunity, and vector competence of biting and nuisance flies.**

* **Ludek Zurek** is examining house flies and Bovine Respiratory Disease (BRD) virus, which is often associated with the bacteria *Mannheimia haemolytica*, *Pasteurella multocida*, and *Histophilus somni* in clinical cases of BRD. He has developed primers for all three bacteria and will now survey house flies for their presence. Ludek is also looking at 7 strains of shigatoxin-producing *E. coli* besides 0157:H7. They are common in house flies but not stable flies. However, house flies collected from restaurants so far haven’t had shigatoxic *E. coli*, suggesting that the “urban” flies are losing the pathogens during the journey from farm to town. The prevalence of 0157 on farms is about 4%.
* **Dana Nayduch** discussed a variety of topics on house fly-bacterial interactions. She is using fly transcriptomics and microbiome analysis to understand how flies use various manures and finding that flies have massive expansion and redundancies in immune genes. Are they using these genes to help with feeding and defense? So far 12 defensins have been found, including digestive lineages that are more recent and common in adult flies. She is also working on excretion of *Salmonella typhimurium* by adult house flies, specifically effects of sex and dosing. Female flies acquire more cfu’s than males, but males excrete more. Flies fed low doses excrete more cfu’s than flied fed on higher doses, probably because higher doses trigger a stronger immune response.
* **Jessica Thompson**, Dana Nayduch’s student, presented information on how cantaloupe facilitates transmission of *Salmonella typhimurium* between house flies. Flies lost most of the ingested bacteria within 6 hours when no food was present. When cantaloupe was present, flies transmitted bacteria to the fruit and replicated a great deal over the next 24 hours. Healthy flies became infected when they fed on the fly-contaminated cantaloupe.
* **Pia Olafson** reported to the group via Zoom Conference because she was unable to make it to the meeting. She discussed a project involving genotyping cattle and assessing horn fly resistance. A team has been put together for this work, and the next step will to examine two herds at the Meat Animal Research Center (MARC) that have been genotyped. The animals are now being phenotyped for fly burden, as will be their calves. The work could lead to identifying specific genes involved in fly resistance, which in turn could facilitate breeding for resistant lines of cattle.
* **Lettie McCay**, a student at the University of Tennessee, surveyed cattle producers in TN, TX, and NM to see how strong an interest they had in buying horn fly-resistant cattle. Results from Tennessee have been collated: 79% would pay $1500 more for a bull that was horn fly resistant and 82% would pay more for a resistant bull overall; 94% would pay more to have all-resistant animals in their herds.
* **John Stoffolano** discussed a wide range of topics on house fly, including: 1) antimicrobial peptides (AMP’s) are produced by the salivary and labellar glands and go into the crop; 2) flies as vectors of *Chlamydia* responsible for trachoma; 3) role of flies in transmission of ORF, or sore mouth disease of sheep in Italy; 4) toxic effects of chitosan on adults, possibly due to interference with gut microflora; 5) neuronal connections in the crop and the effect of serotonin on crop contraction rates; 6) biofilm production by *E. coli* on the interpseudotrachae of adult flies; 7) salivary gland hypertrophy virus; 8) up-regulation of antimicrobial products in the salivary gland following fungal challenge.
* **Nancy Hinkle** has a new paper coming out in the Science of the Total Environment on bacteria associated with flies on Georgia dairies.

**Meeting adjourned for day and reconvened on Thursday at 8:30 AM**

**Objective 4. Characterize population biology of biting and nuisance flies.**

* **Travis Davis,** a graduate student at the University of Tennessee, discussed plans for his MS thesis. He will be using mitochondrial and nuclear DNA to analyze relationships among the 50 species of *Tabanus* in the southeastern US. He also wants to map distributions for all the species using museum specimens and volunteer collectors in different locations. He hopes to use niche modelling to characterize species distribution as a function of factors such as altitude, temperature, rainfall, and vegetation index.
* **Phillip Shultz**, a graduate student at Texas A & M, is working on population genetics of *Culicoides sonorensis*. He is using SNP’s to look at gene flow and dispersal, hybridization with *C. vitripennis* and *C. occidentalis*, and possible cryptic species. He is working closely with deer ranchers. Objectives include determining whether *C. varipennis* has cryptic species and understanding *C. sonorensis* gene flow in ways that could predict or mitigate future bluetongue outbreaks.
* **Dave Taylor** discussed the growing problem of stable flies developing in crop residues. He presented information from southwest Australia, where the main culprit is residues from truck farms growing beets, celery, lettuce, etc. The soil is coarse and sandy and the crop residues are producing 200-500 stable flies per square meter, resulting in unbearable fly burdens on nearby cattle. Dave also did a lab study in which he diluted fly larval diet with vermiculite to produce a range of diets with decreasing available nutrition for the larvae. Stable fly larvae grown in “poor” media developed just as fast as on good media but produced smaller-sized adult flies.

**Objective 5. Community and stakeholder involvement.**

**Alec Gerry** announced that his Veterinary Entomology website has moved from UCR’s server to a .org domain on the WIX platform. It has documents on biology of veterinary pests and the pesticide database VetPestX. The website could use a little more information in the “Training and Education” section, and the “other resources” section also needs more content. Perhaps information about the LIWC or S1060 could find a place in there.

**Becky Trout Fryxell** is working with **Pia Olafson** on the topic of developing horn fly resistant cattle. They did a survey of cattle producers on the status of horn fly management: 1) most feel that flies jeopardize animal comfort; 2) many aren’t sure that they can identify which flies they have; 3) most get their pest management information from Extension, other farmers, and popular media; 4) they don’t want information delivered through apps or learning modules; 5) they do want direct training, web sites, YouTube tutorials, and print articles. They would like to develop a program that allows producers to take a photo of flies on their animals, send it in, and have flies identified, counted, and a recommendation of whether treatment is warranted. They are looking for collaborators to help identify high- and low-fly carrying cattle. They are getting closer to identifying the genes involved in resistance to flies. This work requires funding for the genotyping and needs industry backing to push it forward.

**Business Meeting**

* Las Cruces, New Mexico was nominated, voted on, and approved for the 2019 meeting. **Brandon Smythe** will host, and the meeting will be held the week of January 21st.
* New officers were elected for the next iteration of the project: **Becky Trout Fryxell** (Chair) and **Erika Machrtinger** (Co-Chair). **Chris Geden** will continue to serve as secretary.
* There is still about $6000 left over from the award that S-1060 received. Some of the money will be used to fund student travel to the 2018 LIWC, and **Alec Gerry** will receive $1000 to produce 4 YouTube clips on veterinary pests. **Becky Trout Fryxell** agreed to handle the LIWC student travel awards.
* **Alec** suggested that a committee be formed to oversee the Veterinary Entomology website. Several people volunteered to serve: **Brandon Smythe, Gary Brewer**, **Becky Trout Fryxell, Phil Kaufman, Dave Taylor, Erika Machtinger, and Jerry Zhu.**
* **Becky** called **Kristina Freisen** to discuss the new project plan. Kristina is resigning effective February 23 but will see the project re-write through and publish outstanding data from collaborations. She pointed out areas where the group needed to do some work on the new project, especially to identify collaborations for the objectives.
* The rest of the day was devoted to a long discussion of the new project, identifying objectives, adding outcomes, outputs, and milestones, and listing collaborators.
* **Wes Watson** pointed out that a group at MIT has an app called “Dotcount” that can be used and trained to count just about anything.
* After thanking local arrangement coordinator **Jerry Hogsette** and de-facto meeting chairs **Alec** and **Becky**, the meeting was adjourned at 5 PM.