RESEARCH PROGRESS REPORT SUMMARY

Grant 01780: Defining the Mechanism by Which Ticks Locate Dogs in Order to Better Prevent Disease Transmission

Principal Investigator: Emma Weeks, PhD

Research Institution: University of Florida

Grant Amount: $104,867.31

Start Date: 3/1/2013 **End Date:** 2/28/2019

Progress Report: End-Year 5

Report Due: 8/31/2018 **Report Received:** 12/24/2018

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Original Project Description:

The brown dog tick (BDT) is common across the U.S. and is the most widely distributed tick in the world. BDT's carry and transmit the pathogens that cause debilitating diseases such as canine ehrlichiosis and babesiosis. Prevention of these diseases is accomplished through tick control. BDT's can complete their entire life cycle indoors, making management difficult. Records of infestations are increasing and unpublished data indicates that a high level of pesticide resistance is present in domestic populations. Consequently once introduced, these ticks are particularly hard to eradicate and as one female tick may lay 5,000 eggs, the problem soon gets out-of-hand. Pesticide resistance leads to aggressive treatment regimes, which in turn, lead to increased exposure of humans and pets to chemical residues. Alternatives to pesticides are needed. Studies have shown that BDT's are attracted to dog odor, a blend of volatile chemicals used by ticks to find a blood meal. In this study, Dr. Weeks will identify the chemicals BDT's use to locate a dog. This will enable manipulation of tick behavior thereby facilitating management and reducing the need for extensive use of pesticides. Improved tick control without the need for increased environmental pesticide applications will improve the quality of life for dogs and their owners.

Publications: None at this time.

Presentations:

Weeks, E. N. I., P. E. Kaufman, S. A. Allan, and F. M. Oi. (2013). Brown dog tick research at UF. Poster presentation: Tick-borne disease symposium. UF, Gainesville, FL.

Weeks, E. N. I. (2013). Brown dog tick integrated pest management. Invited speaker: Ross University, St Kitts and Nevis.

Weeks, E. N. I. (2013). Chemical ecology of hematophagous arthropods. Invited speaker: seminar class in Insect Chemical Ecology, Entomology and Nematology Dept., University of Florida.

Weeks, E. N. I. (2013). Host location cues for management of the brown dog tick, *Rhipicephalus sanguineus*. Invited speaker in the student symposium on Chemical cues in insect ecology. Entomological Society of America-Southeastern branch meeting, Greenville, South Carolina.

Weeks, E. N. I. (2015). Chemical ecology of hematophagous insects. Invited speaker: Chemical Ecology seminar, Entomology and Nematology Dept., University of Florida.

Weeks, E. N. I., S. A. Allan, P. E. Kaufman and B. Cantrell (2015). Chemical ecology of the brown dog tick, *Rhipicephalus sanguineus* and response to dog-derived kairomiones. Entomological Society of America-Southeastern branch meeting, Biloxi, MS.

Weeks, E. N. I., B. Cantrell, P. E. Kaufman, and S. A. Allan (2016). Host location cues of the brown dog tick, *Rhipicephalus sanguineus*. Invited speaker: International Congress of Entomology, Orlando, FL, September 2016.

Weeks, E. N. I., S. A. Gezan, P. E. Kaufman, and S. A. Allan (2017). Identification of host attractants for the brown dog tick, *Rhipicephalus sanguinueus*: electrophysiological studies. Poster presentation. Southeastern branch meeting of the Entomological Society of America, Memphis, TN. March 2017.

Weeks, E. N. I. (2017).Chemical Ecology of the Brown Dog Tick, *Rhipicephalus sanguineus*. Invited speaker: Insect Chemical Ecology, University of Florida, Gainesville, FL.

Weeks, E. N. I., P. E. Kaufman, and S. A. Allan (2018). Integrated pest management of the brown dog tick. Invited oral presentation. American Mosquito Control Association, Kansas City, MO. February 2017.

Weeks, E. N. I. (2018). Utilizing behavior to improve management of the brown dog tick. National Conference on Urban Pests, Cary, NC. May 2018.

Weeks, E. N. I. (2018). Tick sensory ecology. CDC Southeastern Center of Excellence in Vector Borne Diseases Tick Workshop. May 2018.

Report to Grant Sponsor from Investigator:

The brown dog tick (BDT) is common across the US and the most widely distributed tick in the world. BDT's are capable vectors of pathogens that cause canine ehrlichiosis and babesiosis as well as other disease agents. Prevention of these diseases is accomplished through tick control. BDT's can complete their entire life cycle indoors, making management difficult. Records of infestations are increasing and unpublished data indicates that a high level of acaricide resistance is present in domestic populations. Consequently once introduced, these ticks are particularly hard to eradicate and as one female tick may lay 5,000 eggs, the problem soon gets out-of-hand. Acaricide resistance leads to aggressive treatment regimes, which in turn, leads to increased exposure of humans and pets to acaricide residues. Alternatives to pesticide applications are needed. Studies have shown that BDT's are attracted to dog odor, a blend of volatile chemicals used by ticks to find a blood meal. Identification of the chemicals BDT's use to locate a dog (semiochemicals) would enable manipulation of tick behavior thereby facilitating management and reducing the need for extensive use of acaricides. Improved tick control without the need for increased acaricide applications will improve the quality of life for dogs and their owners or handlers. Work will be accomplished through four successive objectives to 1) collect dog odor, 2) identify chemicals that ticks can detect, 3) test chemicals for tick attraction and ultimately 4) evaluate efficacy of an attractant-based tick trap.

For the first objective, the collection of dog odor, all animals have been identified and the samples have been collected and analyzed by chromatographic techniques. Furthermore the chemicals have been identified tentatively by mass spectrometry. For the second objectives the electrophysiological techniques have been established and ten ticks have been tested against each dog breed sample plus a mixed sample of all dog breeds (Total 60 ticks). Comparisons between the electrophysiological responses by breed have been made and those peaks producing consistent responses in tick sensory organs have been identified. For the third objectives the behavioral assay has been established. Attraction has been demonstrated to whole dog hair samples and positive controls. Further studies will test the electrophysiologically active chemicals in the behavioral bioassay to determine behavioral role and impact. The most attractive chemicals will be tested in a semi-field trapping system for potential use in a monitoring device.