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A Field Trial In Dooly County, Georgia To Rapidly Reduce Mosquito Populations Using The Provector® Tube And Entobac D

Thomas M. Kollars, Jr.[1*], Bannie Hulsey[2]
[1]*Health Sciences, Liberty University, Lynchburg, VA, USA*
[2]*Crisp Academy, Cordele, GA, USA*
Corresponding Author: Thomas M. Kollars, Jr

Abstract: *Mosquito-borne diseases such as West Nile virus and Eastern Equine Encephalitis virus pose an important health risk to residents and travelers to southeastern Georgia. There is an increasing threat of introduction of mosquito-borne diseases, such as Zika and dengue virus, into Georgia where susceptible mosquito species are present. A field trial of the ProVector Tube Applicator with Entobac D pesticide was conducted to determine if the system was effective in reducing mosquito populations in Dooly County, located in southeastern Georgia. Prior to placement of the ProVector Tube with Entobac D Pesticide, there was not a significant difference in mean number of mosquitoes. The test site had a significantly lower mean number of mosquitoes than the control site ($p<0.05$) after two and four weeks . Providing effective, inexpensive, safe and eco-friendly tools for officials and homeowners is necessary in the event local mosquito control is poorly funded.*

Keywords: *public health, Zika, pesticide, vector control, malaria*

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I. Introduction

Nearly 4 billion people are at risk from vector-borne diseases (VBD), with VBD's accounting for more than 17% of all infectious disease cases being caused globally (WHO 2017). Malaria, filariasis and arboviruses, such as dengue, yellow fever virus, Chikungunya, Zika, and Ross River infect millions annually. Mosquito-borne diseases also have an impact on domestic animals as well, such as equine encephalitis viruses and heart worm. Mosquito-borne diseases have significant impact on health in the United States, West Nile, Eastern Equine Encephalitis, La Crosse, St. Louis, and dengue occurring in several states. Zika virus is also an important emerging infectious disease in the United States, particularly in Florida and Texas.

Along with habitat and host species, temperature, humidity, precipitation, are all important factors in determining the presence and abundance of mosquito species in Georgia (Buckner et al. 2011). A number of MBD's occur in Georgia, West Nile virus being the most common, but when cases of Eastern equine encephalitis (EEE) virus occur, the impact on the patient and their family members can be devastating. West Nile virus and EEE are currently a significant health risk in Dooly County, Georgia. Preventing the introduction of mosquito-borne arboviruses, such as dengue, Chikungunya and Zika, along with the presence of competent vectors poses a challenge to public health officials and families. Many counties in the state of Georgia do not have a robust mosquito control division, Dooly County is among them. Despite an epidemic in 2012 of West Nile virus in counties adjacent to Dooly County, no cases were reported in Dooly. Either the population was very lucky, the vector mosquitoes are not found in Dooly County or there is not a sufficient integrated mosquito management plan for the Dooly County. Without an official integrated mosquito management plan, finding cheap, safe, and environmentally friendly options that local officials and citizens can use to rapidly reduce mosquito populations is essential. Here is discussed a new vector control system, consisting of a new applicator and new pesticide, that rapidly reduces mosquito populations and that is flexible enough to be used across habitats and under harsh environmental conditions, and is target specific in delivering a new pesticide to vectors, reducing cost and environmental impact.

II. Methods

An initial mosquito collection was conducted to get a sample of mosquito populations before deployment of the ProVector® Tube (PVT), Figure 1. Mosquitoes were collected at one test and one control site using one CDC trap and two ABC light traps placed at each site during August and September. Each site measured ½ hectare. Octenol tabs and CO_2 bottle were used as bait on the devices. One CDC and two ABC

light traps were also placed, in a similar fashion, at the Control site for two nights each two weeks for one month, Weeks 0, 2 and 4. After the initial mosquito survey, 15 PVT's with Entobac™ D (composed of sugar bait, active ingredients *Bacillus thuringiensis israelensis* (Bti) plus deltamethrin) were placed within a one acre area at the control and test sites. Collection data was analyzed by Analysis of Variance (ANOVA) using Statistica software.

III. Results and Discussion

There was not a significant difference between the mean number of mosquitoes at the control and test sites on week zero (Figure 2) before mosquito control was conducted. After placement of the ProVector Tube with Entobac D, every two weeks there was a significant difference in the mean number of mosquitoes collected at the test site and control sites (Figure 3 and 4). Reducing mosquito populations indoors and outdoors can have a significant impact on malaria and other mosquito-borne diseases. In a study conducted by the Walter Reed Army Institute of Research in Kenya, the ProVector Flower with Entobac (Bti only) was tested against adult mosquitoes. Seven housing compounds with no applicators were included as controls in the study area. After one month, there was a significant reduction of medically important mosquitoes in all nine compounds with the ProVector Flower compared to two of seven control compounds (Chi-square=11.5, $p < 0.05$) (Yalwala et al. 2016). The ProVector Flower has an open face and must be used either indoors or hung in a way to protect it from rain. The ProVector Tube was developed to be used either indoors or outdoors. The colors on these devices are important as they attract different types of species and where a device is used to control medically important mosquitoes, one should have flexibility.The risk of patients or mosquitoes introducing pathogens into the environment populations is a growing risk in the U.S. Introduced autochthonous cases of malaria have occurred in Georgia. Imported cases of malaria, dengue, Chikungunya, and Zika viruses have occurred in Georgia, and several in Dooly County (CDC 2017). If native mosquito species competent to vector malaria and arboviruses are present in Dooly County, rapidly reducing mosquito populations surrounding a person's home is an important strategy in reducing the risk of MBD's spreading to other people and possibly becoming endemic. For example, *Ae albopictus* is an invasive species to southeastern Georgia, and is competent vector of several arboviruses, and may play a role if Zika virus is introduced (Kollars et al 2016). Other mosquito species such as, *Ochlerotatus japonicas, Cu. coronator* have also been introduced into Georgia and could expand their range into Dooly County (Gray et al. 2005, Mullis et al. 2008) . Very little is known of distribution, mosquito species composition or status of mosquito-borne diseases in Dooly County. A systematic mosquito surveillance effort should be conducted to elucidate the species and distribution of mosquitoes and arboviruses in Dooly County. Citizens living in poor and minority neighborhoods may be at particularly high risk from introduced arboviruses (LaDeau et al. 2013) including neighborhoods in Georgia (Kollars 2017). When there is the detection of a patient infected with an introduced arbovirus, the Dooly County and other Public Health officials can respond and assist. Cooperation between agencies to assist in other jurisdictions has worked to reduce risk of MBD in Georgia. For example, an imported case of Chikungunya was reported in Bulloch County, Bulloch relied upon the neighboring Mosquito Control Division of Chatham County and the CDC to conduct surveillance and control (personal communication).

Providing inexpensive and ecosafe products may help to protect public health where; mosquito control programs are not available or lack adequate funding and personnel, rapid response with adequate equipment is not available. The ProVector® Tube with Entobac D provides rapid effective control of mosquito populations, while being inexpensive, target specific and environmentally friendly. Additional studies in Dooly County should be conducted to evaluate new technologies of mosquito control and to identify mosquito species and their distribution in the county.

IV. Acknowledgement

This study was supported in part by the Research Foundation of Georgia Southern University. This manuscript is dedicated to the memory of Peggy Kollars, co-author, mother, wife, scientist, teacher and friend who has gone on to Heaven. The co-authors know that we will see Peggy again because we also have faith in Jesus. Statement of Conflict of Interest: Prof. Thomas Kollars is the inventor of ProVector® and Entobac™.

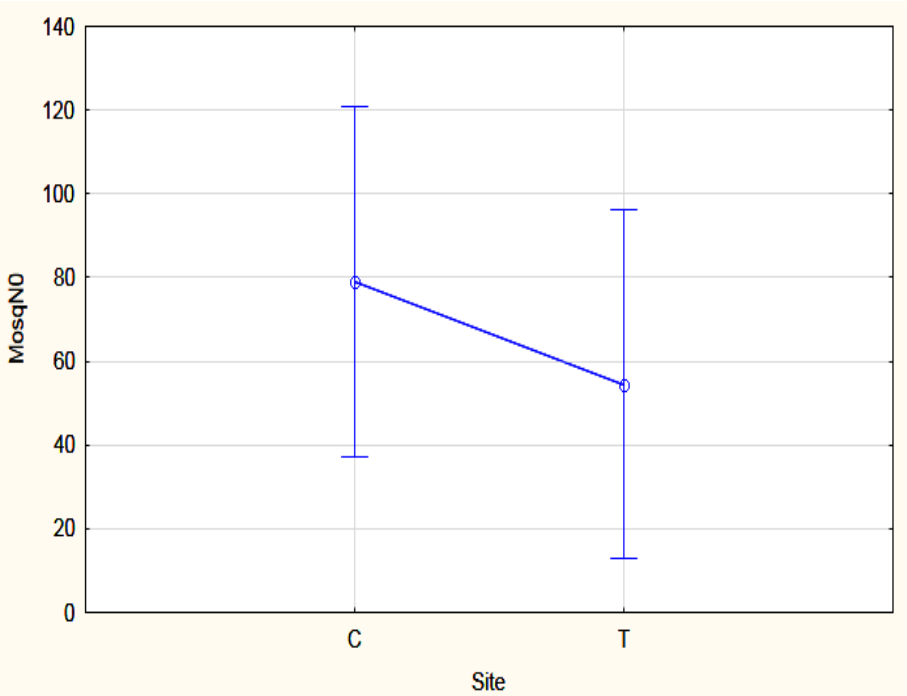
References

[1]. Buckner EA, Blackmore MS, Golladay SW, & Covich AP (2011). Weather and landscape factors associated with adult mosquito abundance in southwestern Georgia, U.S.A. J Vect Ecol 36: 269-78.
[2]. Centers for Disease Control and Prevention (2017). Under case counts of arboviruses for 2013 through 2017. https://www.cdc.gov.
[3]. Gray EW; Harrison BA; Womack ML; Kerce J; Neely CJ; Noblet R (2005). Ochlerotatus japonicus japonicus (Theobald) in Georgia and North Carolina. J Am Mosq Cont Assoc. 21: 144-146.
[4]. Kollars TM, PG Kollars, B Hulsey (2016) Reducing the risk to marine ports from invasive mosquito species, Zika, dengue, chikungunya viruses and filariasis. Intl J Med. 4:70-73.

[5]. Kollars, TM (2017) Identifying Health Disparities of Mosquito-Borne Diseases in Low and Medium Income Communities in Savannah, Georgia, USA. Ann Community Med Pract 3: 1-3.
[6]. LaDeau SL, Leisnham PT, Biehler D, Bodner D (2013). Higher Mosquito Production in Low-Income Neighborhoods of Baltimore and Washington, DC: Understanding Ecological Drivers and Mosquito-Borne Disease Risk in Temperate Cities. Int J Env Res Pub Hlth; 10: 1505-1526.
[7]. MacArthur JR, Holtz TH, Jenkins J, Newell JP, Koehler JE, Parise ME and Kachur SP (2001). Probable Locally Acquired Mosquito-Transmitted Malaria in Georgia, 1999 Clin Inf Dis 32: 1248.
[8]. MMWR Morb Mortal Wkly Rep. (1997) 46:264-7.
[9]. Mullis RA, Russell JD, Lewandowski HB, Thompson PS & Heusel JL (2008). Culex coronator in Coastal Georgia and South Carolina. J Am Mosq Cont Assoc. 24:588-590.
[10]. USGS (2017) West Nile Virus Disease Map. https://diseasemaps.usgs.gov/mapviewer
[11]. WHO (2017) Vector-borne diseases http://www.who.int/mediacentre/factsheets/fs387/en/
[12]. Yalwala S, Kollars JW, Kasembeli G, Chrisostim BW, Senessie C, Kollars PG, Kollars TM Jr (2016) Preliminary report on the reduction of adult mosquitoes in housing compounds in western Kenya, using Entobac biopesticide and the ProVector Flower. J Med Ent 83: 1252-1244.

Figure 1. The ProVector® Tube Applicator uses different colors to attract different mosquito species, which feed through holes in the bottom of the tube on an attractant bait, protecting non-target species such as bees and butterflies.

Figure 2. Mean number of mosquitoes captured at control and test sites, Week 0;
ANOVA Current effect: F(1, 14)=.79233, p=.38844


140
120
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40
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Site

Figure 3. Mean number of mosquitoes captured at control and test sites, Week 2; ANOVA Current effect: F(1, 14)=7.3661, p=.01679

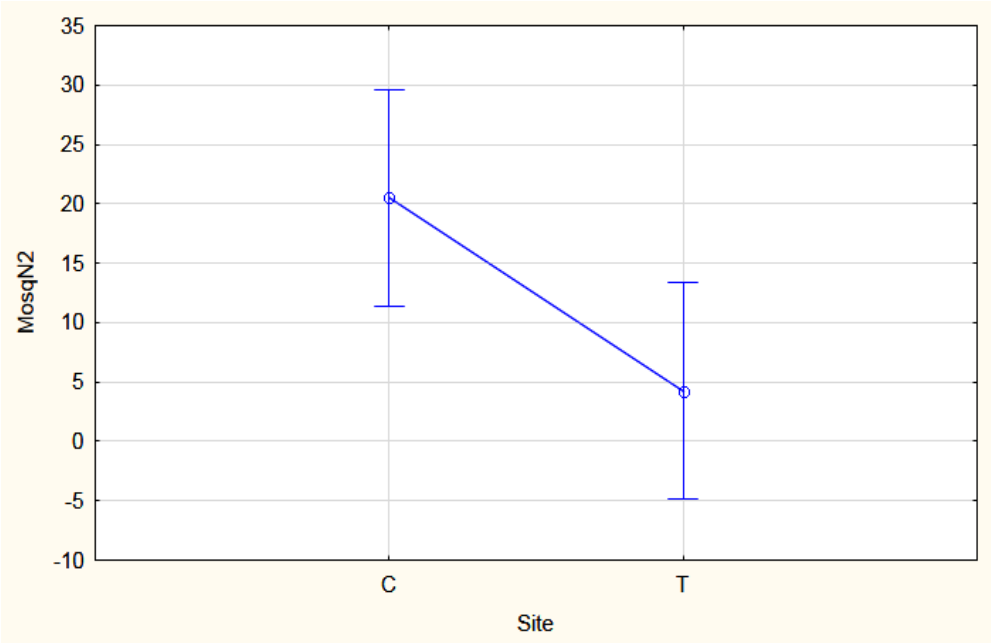
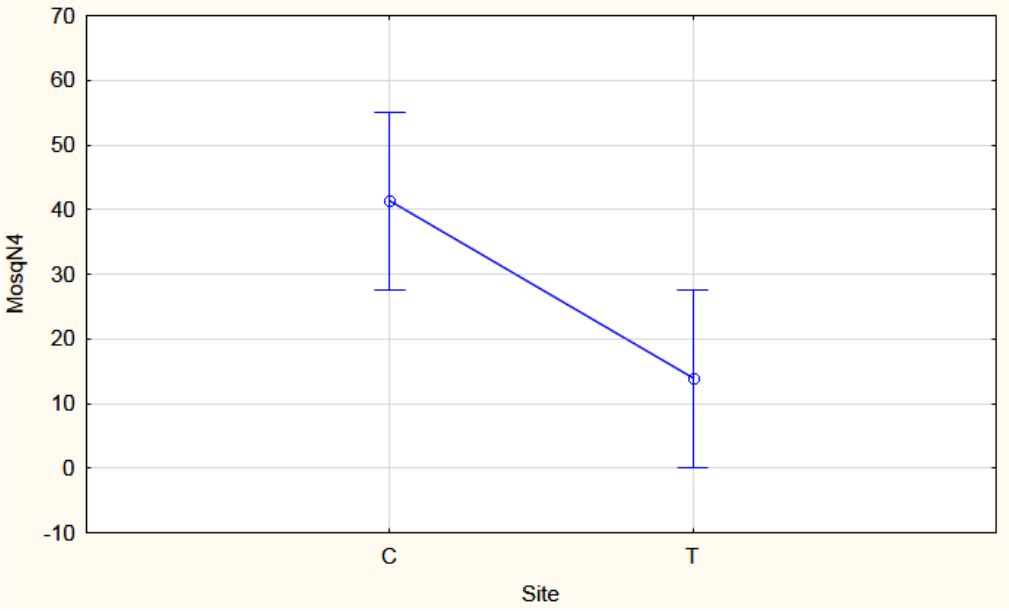


Figure 4. Mean number of mosquitoes captured at control and test sites, Week 4; ANOVA Current effect: F(1, 14)=9.1811, p=.00900



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