Quest Journals
Journal of Medical and Dental Science Research
Volume 4~ Issue 8 (2017) pp: 26- 28
ISSN(Online) : 2394-076X ISSN (Print):2394-0751
www.questjournals.org

Research Paper

Reducing Mosquitoes in Homes in Afienya, Ghana

*Thomas M. Kollars, Jr.[1],Alfred Clottey[2],Emmanuel Clottey[3],Peggy G. Kollars[4]
[1]*Department of Health Sciences, Liberty University, USA*
[2]*Department of Agriculture, Ghana*
[3]*Department of Kinesiology, Louisiana State University Shreveport, USA*
[4]*MedEnvVet Laboratories, USA*
*Corresponding Author: *Thomas M. Kollars, Jr*

Received 01 November, 2017; **A**ccepted 09 November, 2017 © The Author(S) 2017. **P**ublished With Open Access At **Www.Questjournals.Org**

ABSTRACT: *Mosquito-borne diseases continue to be a public health threat to people in Africa, particularly children. Pesticide resistance continues to be a problem for public health officials seek to control mosquito populations and reducing the risk of mosquito-borne disease. Developing new effective, economical and eco-friendly methods is a critical part of a successful integrated vector management program. Reducing mosquito populations will save countless lives while protecting the environment. The ProVector pesticide system is the first technology to use an applicator to deliver a pesticide bait that kills both adult and larvae mosquitoes, with the added benefit of being non-toxic. The ProVector has been tested globally with success in reducing mosquito population. Here we describe the effectiveness of the ProVector Flower with Entobac in reducing mosquito populations for 12 weeks, using surveys of homeowners in the city of Afienya, Ghana.*

Keywords: *Arbovirus, Malaria, Vector Control, Bacillus thuringiensis israelensis, Pesticide*

I. INTRODUCTION

The major vector-borne diseases in Ghana are malaria, dengue fever, and yellow fever [1]; Chikunguyna, West Nile virus and filariasis are also endemic. Malaria accounts for the third highest cause of death in Ghana, ranking just below respiratory infection and stroke [2]. The reduction of mosquito vectors is critical for reducing the risk of these mosquito-borne diseases to communities. Some regions of Ghana are prone to flooding, further increasing the risk of malaria and other mosquito-borne diseases [3]. Indoor residual spraying (IRS) and the use of insecticide treated nets (ITN) are integral in malaria vector control programs in Ghana, and other African countries. However, pesticide resistance is a growing problem in several countries and in Ghana high survival rates using WHO bioassay tests were recorded for all insecticide classes except the organophosphates [4]. As a part of an integrated vector control program, applying repellents, wearing long sleeves and pants, reducing breeding sites, and providing screens are non-pesticide alternatives to spraying and insect treated bed nets but they do not sufficiently reduce mosquito populations. In addition to the growing problem of pesticide resistance, indoor mosquito control has put selective pressure on mosquitoes to feed earlier in the evening and to feed more often outdoors [5]. The ProVector with Entobac pesticide, active ingredient Bacillus thuringiensis israelensis, (Bti) has been used in several countries, indoors and outdoors to reduce several medically important mosquito species, including malaria and arboviruses. Entobac is unique in that it is non-toxic and is the only pesticide to kill both adult and larvae mosquitoes [6,7].

II. METHODS AND RESULTS

One ProVector Flower with Entobac bait pads (Bti plus honey formulation) were provided to 15 home owners in Afienya, Ghana. Homeowners were surveyed every two weeks for three months to evaluate the effectiveness of the ProVector Flower in homes. Estimates were based on lingual descriptors and assigned to fuzzy memberships, then defuzzified to numeric values based upon the number of mosquitoes [8]. Mosquito numbers decreased after two weeks of use of the ProVector Flower, with a significant reduction at 6 weeks over the pre-estimate [Table 1] with the start of recovery by the mosquito population after week 10 [Figure 1].

III. DISCUSSION

Mosquito-borne diseases will continue to be a problem, particularly with diseases that are incurable or where no vaccines are available, e.g. dengue and malaria. Effective methods to reduce mosquito populations below the threshold of disease transmission without selecting for pesticide resistance will also be a continual challenge. The ProVector pesticide system is a technology that uses a colored applicator to attract mosquitoes where the vector feeds on a non-toxic pesticide. An advantage of using an applicator with bait is that pesticides affect only target organisms at a rate that may reduce the development of resistance. In Afienya, the mosquito population was reduced but at a rate slower than found in other studies [6, 7]. This may be attributed to variations in habitat or perception of home owners. Interestingly, the mosquito population in Afienya began to increase slightly between weeks 10 and 12 [Figure 1], this same increase was found in Kibera (Kenya) and Akuse (Ghana) indicating the Entobac bait pad was used up [8]. This consistent pattern of mosquitoes depleting the bait is helpful both in public health supply logistics, planning for integrated vector management and for informing homeowners when to replace the bait pad.

In addition to outdoor spraying of pesticides, ingenious methods have been developed to reduce adult mosquito populations, such as placing ITN's outdoors around cattle enclosures [5]. Like ITN's, the ProVector Flower with Entobac can be placed inside or outside homes. However, with the ProVector, non-target species such as bees and butterflies will not be negatively impacted and pesticides will not be released into the environment by rain. Entobac is the first pesticide that is effective in killing both adult and larvae mosquitoes. Adult mosquitoes are attracted to the colors on the device, feed on the Bti bait and succumb within a few days. If the adult mosquitoes die and land in water, larvae mosquitoes are subsequently killed. This can result in a 250% expansion of reduction over the expected coverage area. ITN's placed outdoors can reduce mosquito populations, however a concern with using outdoor ITN's is the emergence of resistance. ProVector with Entobac reduces the risk of resistance developing because resistance to Bti has not been detected in wild populations of mosquitoes [9]. In addition, only small amounts of Bti are directly released to the individuals of the target species not sprayed in the environment, reducing the risk of resistance to Bti developing in wild populations. Home owners often use coils to supplement mosquito control or when ITN's and IRS are not available or affordable. Mosquito coils for indoor use have been shown to be ineffective in reducing mosquito populations and to have negative health impacts on the persons in the home [10]. One of the problems with ITN's is that users may not use them when the night is hot and people cannot eat dinner or go to the latrine while under the bed net, this is one reason people use coils. As mentioned earlier, temporal and spatial changes in host seeking behavior by vector species further add to the need to use supplemental vector management solutions. The ProVector Flower has been shown to be effective in reducing mosquito species outdoors in several countries.

Malaria transmission is high in several regions in Ghana, often in urban area with rural characteristics [11]. Malaria is highly prevalent in Afienya due to high humidity and rainfall but prevalence is also related to the proportion of middle income households in the area and the proportion with no formal education [12]. The Forest Zone followed the same trend, with maximum EIR occurring in April, and an average annual of 81 infective bites per year, twice the district average [13]. Homeowners should be encouraged to use more than one method to control mosquitoes in and surrounding their homes. Previous studies suggest the ITN be used with coils, and that colored nets are more attractive to users [14]. This same recommendation is suggested for the ProVector System. The ITN is effective in reducing mosquito populations and protecting people from vectors at night. The ProVector system provides a new, safe, and effective supplement the use ITN's, 24 hours a day with no pesticide resistance. The ProVector can use a number of pesticides with bait, e.g. Entobac (Bti), Entobac D (Bti plus Deltamethrin), Entobac M (Bti plus Methoprene). The incorporation of Bti into the control strategy may help reduce pesticide resistant mosquito populations, the use of deltamethrin provides rapid knockdown and the use of methoprene reduces fecundity of female mosquitoes and larva development. As in Kibera, Kenya [8], the ProVector System can provide additional protection to families from mosquito-borne diseases as part of the integrated vector control management program in Ghana.

IV. CONCLUSION

The ProVector Flower was easily into homes as it is colorful, safe and effective. In some cases, the ProVector should incorporate the Entobac D bait for rapid knockdown for the first month, with a switch to Entobac or Entobac M to have efficacy over a large area. Additional ProVector systems are being tested, including the ProVector Super Netty, which uses empty water bottles, thus reducing cost, waste and breeding sites. Further development of new technologies and pesticides which are effective against pesticide resistant mosquito species will be an ongoing effort as mosquito-borne diseases increase globally.

V. ACKNOWLEDGEMENTS

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.

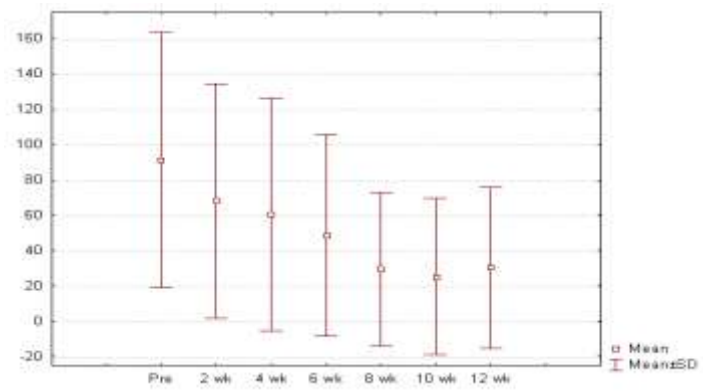
REFERENCES

[1]. Index Mundi, Ghana Major Infectious Diseases, 2017,
[2]. http://www.indexmundi.com/Ghana/major_infectious_diseases.html.
[3]. Centers for Disease Control and Prevention, Global Health Care Ghana, 2017,https://www.cdc.gov/globalhealth/countries/ghana/
[4]. United Nations Office for the Coordination of Humanitarian Affairs (2010). A consolidated report on flood situation in southern Ghana June 2010 Floods. 2010.
[5]. https://reliefweb.int/sites/reliefweb.int/files/resources/7C0465B033F05F8D8525776D00699FE5.
[6]. Hunt R, et al. Insecticide resistance in malaria vector mosquitoes at four localities in Ghana, West Africa , Parasites and Vectors, 2011, 4:107.
[7]. Maia MF, Abonuusum A, Lorenz LM, Clausen PH, Bauer B, The Effect of Deltamethrin-treated Net Fencing around Cattle Enclosures on Outdoor-biting Mosquitoes in Kumasi, Ghana,. PLOS ONE, 2012, 7: e45794. https://doi.org/10.1371
[8]. Yalwala S, Kollars JW, Kasembeli G, Chrisostim BW, Senessie C, Kollars PG, Kollars TM Jr, Preliminary report on the reduction of adult mosquitoes in housing compounds in western Kenya,using Entobac biopesticide and the ProVector Flower, Journal of Medical Entomology, 2016, 83: 1252-1244.
[9]. Kollars TM, Hatfill S, Kollars EL, Neidhardt K. Controlling mosquito populations and reducing the risk of mosquito-borne diseases in a beach resort of Punta Cana using eco-friendly technologies. Journal Pharmacy and Biology, 2016, 11:1-4.
[10]. Kollars TM, Kollars JW, Kithinj J. (2017) Fuzzy Logic Estimation of Mosquito Populations in Homes in Kibera, Kenya. International Journal Family and Community Medicine, 2017, In Press.
[11]. GoldmanF, Arnold J and Carlton BC, Selection for resistance to Bacillus
[12]. thuringiensis subspecies israelensis in field and laboratory populations of the mosquito Aedes aegypti, Journal Invertebrate Patholology, 1986, 47: 317–324.
[13]. Avicor SW, Wajiidi MF, Owusu EO, To coil or not to coil: application practices, perception and efficacy of mosquito coils in a malaria-endemic community in Ghana, Environmental Science Pollution Research, 2017, 24:21138–21145.
[14]. Basing AW, Tay S. (2014) Malaria transmission dynamics of the Anopheles mosquito in Kumasi, Ghana. International Journal of Infectious Diseases, 2014, 21: 22.
[15]. Akpalu W, Codjoe SNA (2013) Economic Analysis of Climate Variability Impact on Malaria Prevalence: The Case of Ghana. Sustainability, 2013, 5: 4362-4378.
[16]. Quartey AA,(2106) Estimation of malaria transmission intensity in southern Ghana using rapid diagnostic test derived sero-prevalence rates. Kwame Nkrumah University, PhD Thesis may 2016, 210pp.
[17]. Baume CA, Franka-Koh AC, Predictors of mosquito net use in Ghana, Malaria Journal, 2011, 10:265.

Table 1. Comparison between Pre and Bi-Weekly Estimates of Mosquito Numbers in Home in Afienye, Ghana

	Valid N	Mean	Std.Dev.
Pre Estimate	**18**	**33.1**	**72.3**
2 wk Estimate	**18**	**38.7**	**66.4**
4 wk Estimate	**18**	**28.1**	**65.9**
6 wk Estimate	**18**	**20.9**	**56.9**
8 wk Estimate*	**18**	**18.4**	**43.4**
10 wk Estimate*	**18**	**17.9**	**44.3**
12 wk Estimate*	**18**	**25.7**	**45.6**

Figure 1. Defuzzivied Estimates of Mosquito Numbers Based on Home Owner Surveys in Afienye, Ghana.



*Thomas M. Kollars, Jr. "Reducing Mosquitoes in Homes in Afienya, Ghana." Quest Journals Journal of Medical and Dental Science Research , vol. 04, no. 08, 2017, pp. 26–28.