VOLUME 1

Title

Spartan Mosquito Eradicator Pro Tech
EPA Reg. No. 93813-R
Additional Laboratory Efficacy Evaluation Against
Aedes aegypti, Culex quinquefasciatus, and *Anopheles quadrimaculatus*

Data Requirements

Invertebrate Control Agent Product Performance Testing Guidelines
(OCSPP Guideline 810.3400)
Mosquito, Black Fly, and Biting Midge (Sand Fly) Treatments

Authors

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Prepared by

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Date Completed

January 10, 2020

Sponsored/Submitted by

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Study ID

AC2T-20200110-1

STATEMENT OF NO DATA CONFIDENTIALITY CLAIMS

No information is claimed confidential on the basis of its falling within the scope of FIFRA §10(d)(1)(A), (B) or (C).

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Technology Sciences Group, Inc.

Date: January 10, 2020

NOTICE

This report is the property of AC2T dba Spartan Mosquito and, as such, is considered to be confidential for all purposes other than compliance with FIFRA Section 10. Submission of this report in compliance with FIFRA does not constitute a waiver of any right to confidentiality that may exist under any other statute or in any other country.

GOOD LABORATORY PRACTICES STATEMENT

This study was not conducted in full compliance with Good Laboratory Practices as outlined in 40 CFR 160; however, the data reported herein were collected using sound scientific principles, trained staff persons, and robust procedures.

Sponsor /
Submitter:

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Executive Summary

As a follow-up from Agency e-mail communication received on December 17, 2019 requesting replicate laboratory bioassay data, Spartan Mosquito is pleased to provide the enclosed additional laboratory efficacy evaluations of the Spartan Mosquito Eradicator Pro Tech product against additional mosquito species in the laboratory setting. Additional trials were conducted against *Aedes aegypti* and *Culex quinquefasciatus* and new trials were conducted to determine effectiveness against *Anopheles quadrimaculatus*. The Spartan Mosquito Eradicator Pro Tech is a unique pesticide product for the control and suppression of mosquito populations. It is an attractive insecticide bait product containing 9.04% boric acid as the toxicant; however, the in-use diluted concentration is 2.3% boric acid once warm water is added to the product. Other inert ingredients in the product are used to attract mosquitoes and once the product is ingested, boric acid will kill the target mosquito pest. Prior to placement of the product tubes, warm water is added to the product to initiate attractancy. A specialized cap is placed onto the tube with openings large enough only for mosquitoes to gain access and enter but small enough that other non-target organisms, such as honeybees, butterflies, or hummingbirds, cannot access the product. This specialized cap also affords the ability for the product tube to naturally replenish with rain water over the life of the product as initial water levels may decrease due to evaporative losses.

The previous laboratory studies (MRID No. 50904503) presented and demonstrated effectiveness against *Culex quinquefasciatus* and *Aedes aegypti* with 100% control within several days. Several boric acid formulations that represented an upper and lower dilution range of the Spartan Mosquito Eradicator Pro Tech product were evaluated. A 1.0% boric acid in 10% sugar/water solution was tested to represent an overly diluted product used in the field, and a 3.0% boric acid in 10% sugar/water solution was tested to represent an evaporated product used in the field along with a 10% sugar/water solution to serve as control.

In the present submission, efficacy evaluations were conducted using the product itself, Spartan Mosquito Eradicator Pro Tech at the in-use concentration of 2.3% boric acid post-dilution, rather than formulated concentrations of 1.0% or 3.0% boric acid solutions in 10% sugar/water solution. Based on the relative speed of product effectiveness observed between the former studies in MRID No. 50904503 and the studies presented herein on *Culex quinquefasciatus* and *Aedes aegypti* as well as the similarity in percent boric acid in test solutions, it is reasonable to treat the evaluations on *Culex quinquefasciatus* and *Aedes aegypti* presented herein as replicates of the earlier submitted data.

Similar to the previously submitted efficacy findings in MRID No. 50904503, with respect to the control and treatment groups, allowance was made for mosquitoes that may have died during shipment from the supplier. That is, initial mortality counts were taken prior to exposure to the test material and the adjusted control mosquito counts are reflected in the enclosed reports. Mosquito mortality data were collected over the course of several days, the results of which are included in each report summary section of this volume.

For ***Aedes aegypti*** mosquitoes, greater than 90% control was achieved within 48 hours after initial exposure to the Spartan Mosquito Eradicator Pro Tech product and greater than 99% control was achieved at the end of testing at the 49-hour mark. For ***Culex quinquefasciatus*** mosquitoes, 99% control was achieved within 24 hours after initial exposure.

Anopheles quadrimaculatus mosquitoes were not initially evaluated in the earlier laboratory studies but have been evaluated in triplicate in some recently conducted bioassays. In the first bioassay,

conducted between December 10, 2019 and December 14, 2019, three test trials were conducted (Camera Test Tank, Test Tank A, and Test Tank C), each with concurrent controls (Camera Control Tank, Control Tank B, and Control Tank D). Greater than 90% effectiveness was demonstrated within 72 hours for two trials and at 74 hours for the third trial. All trials demonstrated 100% effectiveness at the close of the evaluation period (80 hours of exposure). In the second replicate bioassay, conducted between December 24, 2019 and December 28, 2019, a second set of three test trials were conducted (Test Tank #2, Test Tank B, and Camera Test Tank), each with concurrent controls (Control Tank #1, Control Tank #3, and Camera Control Tank). Greater than 97% effectiveness was demonstrated in each test group at the close of the evaluation period (90 hours) with one test group achieving 100% control.

The individual reports that follow present, in more detail, the summarized results above.

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Aedes aegypti Inhouse Trials 09/10/19

The data provided within this paper is to provide efficacy of the use of Spartan Mosquito Pro-Tech with regards to the Aedes aegypti.

Setup

This test was conducted using 2 large aquariums (23" X 11" x 14") while monitoring the temperature and relative humidity, for mortality. On 09/10/19 at 1004, mosquitoes arrived for testing, from Benzon Research. The shipping vessel contained 3 cups (approximately 200 mixed sex, per cup), 3 cool packs and packing peanuts. Upon receipt the temperature and relative humidity, of the inside of the vessel, were measured at 53.4 °F and 55% respectively.

The location used for testing was monitored continuously for temperature and humidity during the duration of the test.

Procedure

A single cup of mosquitoes was released into each individual habitat on 09/10/19 at 1450 and allowed to settle for thirty minutes. One habitat included a control with a wicked 10% sugar water food source, placed inside a Spartan tube with no cap. The other habitat contained a Spartan Pro-Tech device. At 1520 initial mortality was observed and recorded. The initial mortality will be used later for the final calculation. For the duration of the test, mortality counts, temperature and humidity were recorded every four to eight hours.

Results

All calculations with regards to % Mortality are calculated as:

(Dead Count – Initial Mortality) / (Total Released-Initial Mortality) * 100 = % Mortality or

(B-A)/(C-A)*100 = % Mortality

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Total in Container		414	422
Dead in container (not released into habitat)		7	22
% Dead in Container		2%	5%
Total Released (into habitat)		407	400
Total Released (into habitat) after intial Mortality		381	369
% Total Released		98%	95%
Tank Name		Camera Test Tank	Camera Control Ta
Habitat Type		Large Aquarium	Large Aquariu
A		Mortality Floor	Mortalit Floor
9/10/2019 @1540	After 30 min. Initial Mortality	26	37
9/10/2019 @1705	Dead Count	28	36
	% Mortality	1%	1%
9/10/2019 @2230	B Dead Count	35	36
	% Mortality	2%	1%

Habitat labeled as "Camera Test Tank" and "Camera Control Tank" generated the following data.

After 49 hours the test and control yielded a % Mortality of 99.21% and 24.93% respectively.

Taking the inverse of the % Mortality to utilize **Abbott's formula**:

Eq. – ((%Alive in Control - %Alive in Test) / % Alive in Control)* 100

With:

Control % Alive: 75.07%

Test % Alive: 0.79%

Abbott = 99.0% reduction.

Count Data

Aedes aegypti

Total in Container		414	422	HOBO Sensor #693			
Dead in container (not released into habitat)		7	22				
% Dead in Container		2%	5%				
Total Released (into habitat)		407	400				
Total Released (into habitat) after Intial Mortality		381	369				
% Total Released		98%	95%				
Tank Name		Camera Test Tank	Camera Control Tank				
Habitat Type		Large Aquarium	Large Aquarium				
		Mortality	Mortality	Temp (°F)		Humidity (%)	
		Floor	Floor	Low	High	Low	High
9/10/2019 @1520	After 30 min. Initial Mortality	26	31	74	77	63	65
9/10/2019 @1705	Dead Count	28	36				
	% Mortality	1%	1%	73	79	59	65
9/10/2019 @2230	Dead Count	35	36				
	% Mortality	2%	1%	71	77	61	67
9/11/2019 @1015	Dead Count	77	57				
	% Mortality	13%	7%	70	78	55	59
9/11/2019 @1500	Dead Count	102	69				
	% Mortality	20%	10%	73	76	59	63
9/11/2019 @1900	Dead Count	143	71				
	% Mortality	31%	11%	76	77	57	63
9/11/2019 @2300	Dead Count	176	77				
	% Mortality	39%	12%	69	76	53	57
9/12/2019 @0610	Dead Count	292	89				
	% Mortality	70%	16%	70	73	54	56
9/12/2019 @0900	Dead Count	330	92				
	% Mortality	80%	17%	73	74	56	66
9/12/2019 @1130	Dead Count	372	109				
32 Alive	% Mortality	91%	21%	72	75	60	66
9/12/2019 @1330	Dead Count	391	115				
13 Alive	% Mortality	96%	23%	74	75	57	59
9/12/2019 @1500	Dead Count	401	122				
6 Alive	% Mortality	98%	25%	72	74	58	61
9/12/2019 @1600	Dead Count	404	123				
3 Alive	% Mortality	99.21%	24.93%				

Key:

% Mortality is calculated as: (Dead count - initial dead count / total released - initial dead count

Does not include mosquitoes in the tube

Confirmed Count

% Mortality used to generate Abbott's Formula

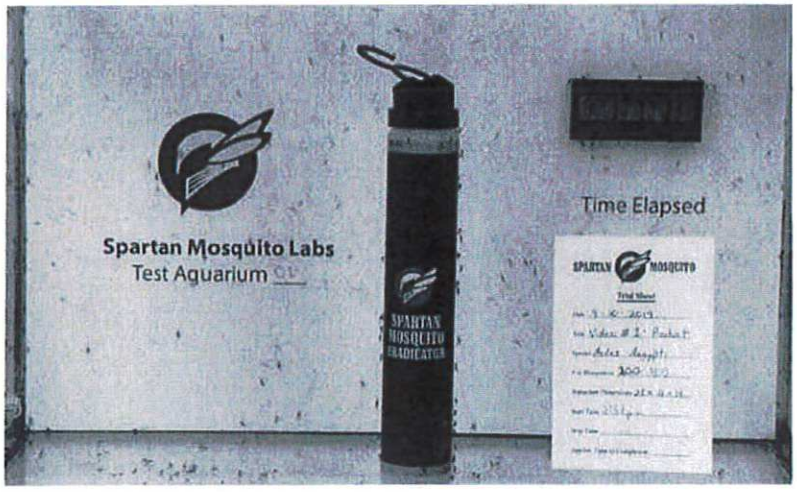
Final numbers including /Test done

Abbott's	% Alive in control	75.07%
	% Alive in Test	0.79%
		99.0%

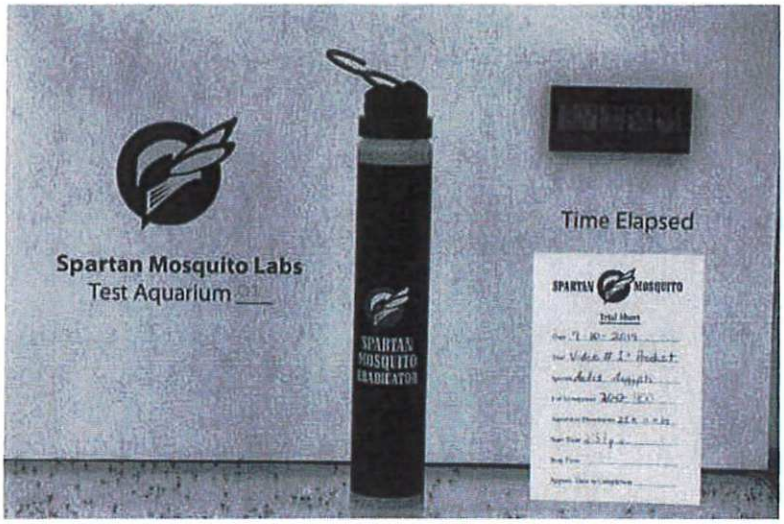
Date and time of receipt at lab	9/10/19 @1004
Date and time opened box	9/10/19 @1023
Internal temperature when opened	53.4
Whats in the package	3 containers -3 gel packs, packing peanuts
Acclamation times	4 hours
Food source	10% sugar water in tap water

Control and Test habitats

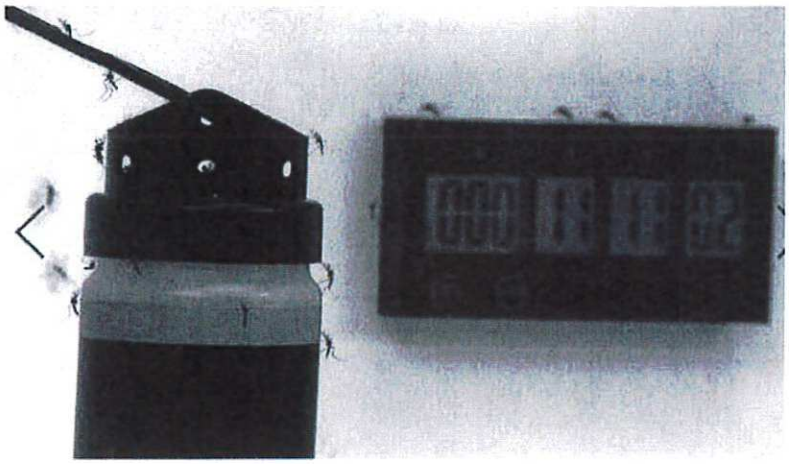
Aedes test habitat at the Start



Aedes test habitat at the End



Aedes entering the holes



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Michael S. Bonner, Ph.D.
Chairman of the Board

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Culex quinquefasciatus Inhouse Trials 09/19/19

The data provided within this paper is to provide efficacy of the use of Spartan Mosquito Pro-Tech with regards to the Culex quinquefasciatus.

Setup

This test was conducted using 2 large aquariums (23" X 11" x 14") while monitoring the temperature and relative humidity, for mortality. On 09/19/19 at 1030, mosquitoes arrived for testing, from Benzon Research. The shipping vessel contained 6 cups (approximately 250 to 300 mixed sex, per cup), 6 cool packs and packing peanuts. Upon receipt the temperature and relative humidity, of the inside of the vessel, were measured at 58.7 °F and 54% respectively.

The location used for testing was monitored continuously for temperature and humidity during the duration of the test.

Procedure

Two cups of mosquitoes were released into each individual habitat on 09/19/19 at 1330 and allowed to settle for thirty minutes. The two habitats include a control with a wicked 10% sugar water food source, placed inside a Spartan tube with no cap, and a test habitat consisting of a Spartan Pro-Tech. At 1400 initial mortality was observed and recorded. The initial mortality will be used later for the final calculation. For the duration of the test, mortality counts, temperature and humidity were recorded every four to six hours.

Results

All calculations with regards to % Mortality are calculated as:

(Dead Count – Initial Mortality) / (Total Released-Initial Mortality) * 100 = % Mortality or

(B-A)/(C-A)*100 = % Mortality

Total In Container		578	587	HOBO Sensor I		
Dead In container (not released into habitat)		8	13			
% Dead in Container		1%	2%			
Total Released (into habitat)		570	574			
Total Released (into habitat) after Intial Mortality		565	553			
% Total Released		99%	98%			
		Camera Test Tank Large Aquarium	Camera Control Tank Large Aquarium			
	A	Mortality Floor	Mortality Floor	Temp (°F) Low	High	Humi Low
9/19/2019 @1400	After 30 min. Initial Mortality	5	21	73	75	58
9/19/2019 @1800	B Dead Count	85	25			
		14%	4%			

Habitat labeled as "Camera Test Tank" and "Camera Control Tank" generated the following data.

After 19 hours and 50 minutes the test and control yielded a % Mortality of 99.47% and 9.40% respectively.

Taking the inverse of the % Mortality to utilize **Abbott's formula**:

Eq. – ((%Alive in Control - %Alive in Test) / % Alive in Control)* 100

With:

Control % Alive: 90.60%

Test % Alive: 0.53%

Abbott = 99.4% reduction.

Culex quinquefasciatus

Total in Container		578	604	HOBO Sensor #693			
Dead in container (not released into habitat)		8	30				
% Dead in Container		1%	5%				
Total Released (into habitat)		570	574				
Total Released (into habitat) after Intial Mortality		565	553				
% Total Released		99%	95%				
Tank Name		Camera Test Tank	Camera Control Tank				
Habitat Type		Large Aquarium	Large Aquarium				
		Mortality	Mortality	Temp (°F)		Humidity (%)	
		Floor	Floor	Low	High	Low	High
9/19/2019 @1400	After 30 min. Intial Mortality	5	21	72	77	60	65
9/19/2019 @1800	Dead Count	85	25				
	% Mortality	14%	1%	73	78	54	62
9/19/2019 @2300	Dead Count	221	37				
	% Mortality	38%	3%	73	77	54	59
9/20/2019 @0500	Dead Count	384	57				
	% Mortality	67%	7%	69	77	55	57
9/20/2019 @1000	Dead Count	402	70				
	% Mortality	70%	9%	72	76	57	64
9/20/2019 @1330	Dead Count	562	73				
8 Alive	% Mortality	99%	9%	73	75	64	66
9/20/2019 @1500	Dead Count	567	73				
2 Alive	% Mortality	99.47%	9.40%				

Key: % Mortality is calculated as: (Dead count - in tial dead count / total released - initial dead count)

Does not include mosquitoes in the tube

Confirmed Count

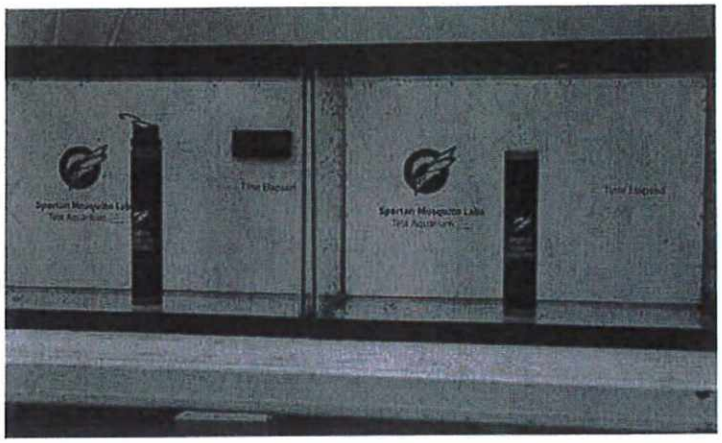
% Mortality used to generate Abbott's Formula

Final numbers including /Test done

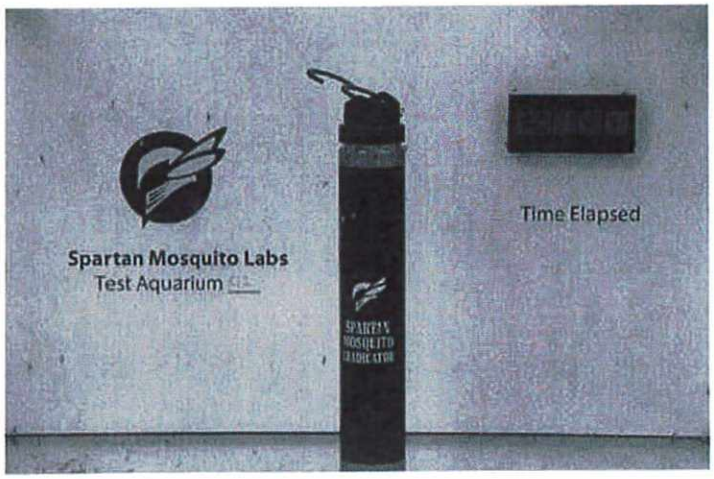
Abbott's	% Alive in control	90.6
	% Alive in Test	0.53
		99.4%

Date and time of receipt at lab	9/19/19 @1030
Date and time opened box	9/19/19 @1030
Internal temperature when opened	58.7
Whats in the package	5 containers - 6 gel packs, packing peanuts
Acclamation times	3 hours
Food source	10% sugar water in tap water

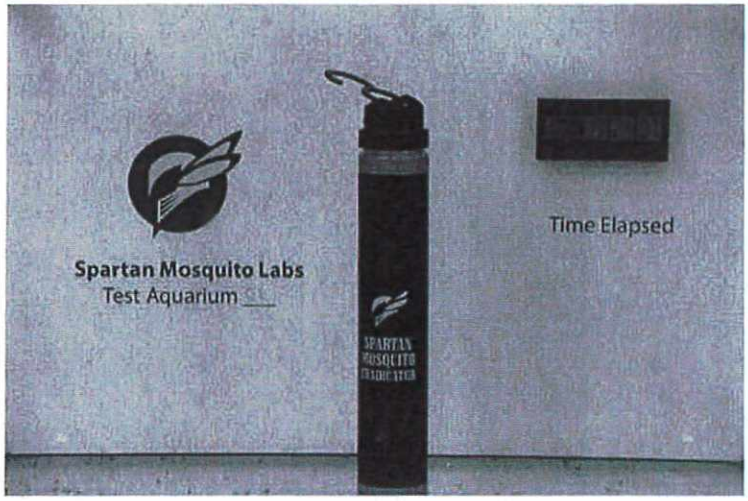
Control and Test habitats



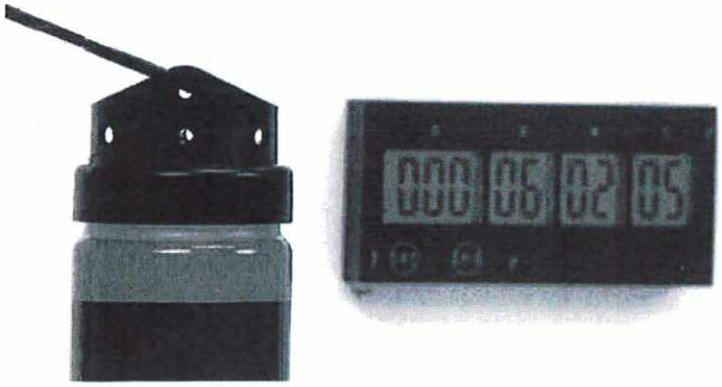
Culex test habitat at the Start



Culex test habitat at the End



Culex entering the device



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Anopheles Inhouse Trials 12/10/19

The data provided within this paper is to provide efficacy of the use of Spartan Mosquito Pro-Tech with regards to the Anopheles quadrimaculatus.

Setup

This test was conducted using various habitats (bug dorms, large aquariums and small aquariums) in the same location while monitoring the temperature and relative humidity, for mortality. On 12/10/19 at 1013, mosquitoes arrived for testing, from Benzon Research. The shipping vessel contained nine cups (approximately 150 mixed sex, per cup), 6 cool packs, moist towels and packing peanuts. Upon receipt the temperature and relative humidity, of the inside of the vessel, were measured at 63.7 °F and 68% respectively. Over the course of the next 7 hours and 15 minutes, the cups where acclimated to a temperature of 78 °F and relative humidity of 70%.

The location used for testing was monitored continuously for temperature and humidity during the duration of the test.

Procedure

A cup of mosquitoes was released into each individual habitat on 12/10/19 at 1830 and allowed to settle for thirty minutes. The six habitats included three controls with a wicked 10% sugar water in each and three product tests consisting of a Spartan Pro-Tech in each habitat. At 1903 initial mortality was observed and recorded. The initial mortality will be used later for the final calculation. For the following four days, mortality counts, temperature and humidity were recorded every two to four ours.

Results

All calculations with regards to % Mortality are calculated as:

(Dead Count – Initial Mortality) / (Total Released-Initial Mortality) * 100 = % Mortality or

(B-A)/(C-A)*100 = % Mortality

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Total in Container		139				
Dead in container (not released into habitat)		1				
% Dead in Container		1%				
Total Released (into habitat)		138				
Total Released (into habitat) after Initial Mortality		135				
% Total Released		99%				
Tank Name		Camera Test Tank				
Habitat Type		Large Aquarium	Sensor #2			
A		Mortality	Temp (°F)		Humidity (%)	
		Floor	Low	High	Low	High
12/30/19 @1903	After 30 min. Initial Mortality	3	77.9	78.7	70.8	80.9
12/30/19 @2245	Dead Count	3				
	% Mortality	0%	77.5	78.5	78.2	81.2
12/31/19 @0100 B	Dead Count	3				

Habitat labeled as "Camera Test Tank" and "Camera Control Tank" generated the following data.

After 80 hours the test and control yielded a % Mortality of 98.52% and 13.61% respectively.

Taking the inverse of the % Mortality to utilize **Abbott's formula**:

Eq. – ((%Alive in Control - %Alive in Test) / % Alive in Control)* 100

With:

Control % Alive: 86.39%

Test % Alive: 1.48%

Abbott = 98.3% reduction.

****

Review of the Test Tank A and Control Tank B, using the above equations, after 70 hours:

Control %Alive: 86.58%

Test % Alive: 2.92%

Abbott = 96.6% reduction.

****

Review of the Test Tank C and Control Tank D, using the above equations, after 68 hours:

Control %Alive: 92.73%

Test % Alive: 0.00%

Abbott = 100% reduction

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Spartan Mosquito Inhouse Testing

Anopheles quadrimaculatus

Total in Container		139					174					144	153	198	198	Sensor # 4			
Dead in container (not released into habitat)		1					4					6	4	5	0				
% Dead in Container		1%					2%					4%	3%	3%	0%				
Total Released (into habitat)		138					170					138	149	193	198				
Total Released (into habitat) after Initial Mortality		135					169					137	149	191	165				
% Total Released		90%					98%					96%	97%	97%	100%				
Tank Name		Camera Test Tank					Camera Control Tank					Test Tank A	Control Tank B	Test Tank C	Control Tank D				
Habitat Type		Large Aquarium	Sensor #2				Large Aquarium	Sensor #1				Bug Dorm	Bug Dorm	Bug Dorm	Small Aquarium				
		Mortality	Temp (°F)		Humidity (%)		Mortality	Temp (°F)		Humidity (%)		Mortality	Mortality	Mortality	Mortality	Temp (°F)		Humidity (%)	
		Floor	Low	High	Low	High	Floor	Low	High	Low	High	Floor	Floor	Floor	Floor	Low	High	Low	High
12/10/19 @1503	After 30 min Initial Mortality	3	77.9	78.7	70.8	80.9	1	78.1	79	77.5	85	1	0	2	3	79.9	80.7	53.5	65.4
12/10/19 @2245	Dead Count	3					1					2	1	2	3				
	% Mortality	0%	77.5	78.5	78.2	81.7	0%	77.2	79.1	81.3	87.5	1%	1%	0%	0%	78.6	80.3	60.2	67.5
12/11/19 @0100	Dead Count	3					1					2	0	2	3				
	% Mortality	0%	77.2	77.5	78.1	82.6	0%	76.8	77.3	86.3	91.5	1%	0%	0%	0%	78.2	79.4	64	68.4
12/11/19 @0308	Dead Count	3					1					3	0	4	3				
	% Mortality	0%	76.9	77.2	78.7	83.3	0%	76.5	76.8	89.1	92.9	1%	0%	1%	0%	77.9	79.1	62.3	68.9
12/11/19 @0510	Dead Count	3					1					3	0	5	3				
	% Mortality	0%	76.8	77.2	79.3	83.1	0%	76.5	77	89.1	93.1	1%	0%	2%	0%	77.9	79.1	62.3	69.4
12/11/19 @0715	Dead Count	3					1					3	0	5	3				
	% Mortality	0%	77.2	77.4	76	81.6	0%	76.9	77.2	86.5	90.7	1%	0%	2%	0%	77	79	62.3	69.7
12/11/19 @0830	Dead Count	5					1					4	0	5	3				
	% Mortality	1%	77.3	78.6	76	79.5	0%	77.2	78.8	85.6	88.5	2%	0%	2%	0%	77.4	80.5	60.3	69.5
12/11/19 @1020	Dead Count	5					1					7	0	9	4				
	% Mortality	1%	78.7	81.5	75.1	78.6	0%	78.8	81.7	80.8	85.9	4%	0%	4%	1%	80.9	83.9	62.1	66.1
12/11/19 @1300	Dead Count	6					1					19	0	15	4				
	% Mortality	4%	81.5	82.1	69.7	76.8	0%	81.8	82.3	75.2	81.6	13%	0%	7%	1%	82.5	84.7	54.3	63.6
12/11/19 @1457	Dead Count	12					1					23	1	27	4				
	% Mortality	7%	81.2	81.7	71	75.1	0%	81.4	81.8	75.7	79.3	16%	1%	13%	1%	82.3	84.3	56.9	62.1
12/11/19 @1704	Dead Count	14					2					36	2	33	6				
	% Mortality	8%	80	81.1	72.7	79	1%	80.1	81.2	76.9	84	26%	1%	17%	2%	81.8	82.8	58.1	66.1
12/11/19 @1857	Dead Count	16					3					44	3	47	5				
	% Mortality	11%	79	80.1	78	79.9	1%	79.7	80.1	77	79.3	31%	2%	24%	1%	79.8	81.9	63.7	68.9
12/11/19 @2100	Dead Count	24					3					52	3	55	5				
	% Mortality	16%	78.3	79	75.1	78.8	1%	78.2	78.9	79.8	84.2	37%	2%	28%	1%	78.3	79.9	64.2	69.7
12/11/19 @2300	Dead Count	27					5					60	3	64	6				
	% Mortality	19%	77.4	78.3	74.6	75.8	2%	77.3	78.3	79.4	81.5	43%	2%	32%	1%	77.2	78.7	64.2	71.3
12/12/19 @0130	Dead Count	35					5					75	4	81	6				
	% Mortality	25%	76.9	77.3	74.8	76.7	2%	76.9	77.4	80.3	82.8	54%	3%	41%	2%	76.5	77.6	68	73.3
12/12/19 @0300	Dead Count	36					5					76	5	84	6				
	% Mortality	26%	76.2	76.9	74.4	77.7	2%	76.1	76.9	80.4	84.4	55%	3%	43%	2%	75.9	76.7	67.1	74.5
12/12/19 @0500	Dead Count	36					6					77	5	85	7				
	% Mortality	26%	75.7	76.2	76.1	78.8	3%	75.6	76.1	83.1	85.7	55%	3%	43%	2%	75.4	76.2	70.3	74
12/12/19 @0700	Dead Count	42					7					83	6	89	7				
	% Mortality	29%	75.8	76.7	76.9	78.9	4%	75.7	76.8	83.4	85.4	60%	4%	46%	2%	75.7	76.9	72.6	77.2
12/12/19 @0900	Dead Count	46					10					88	6	94	8				
	% Mortality	32%	76.7	77.8	76.4	78.8	5%	76.9	78	83.7	85.3	64%	4%	48%	3%	76.6	78.2	72	76.5
12/12/19 @1100	Dead Count	53					13					91	6	91	8				
	% Mortality	37%	77.8	78.8	76.7	78.9	7%	78	78.9	83.5	85.1	66%	4%	48%	3%	78.3	79.2	72.3	76.4
12/12/19 @1311	Dead Count	57					13					102	7	101	10				
	% Mortality	40%	78.8	79.5	75.3	78.4	7%	78.9	79.5	82.1	85.3	72%	5%	53%	4%	79	80.1	69	75.8
12/12/19 @1515	Dead Count	59					13					100	8	110	11				
	% Mortality	41%	79.4	80	73.7	76.1	7%	79.5	80.1	78.1	82.4	72%	5%	57%	5%	79.5	80.4	69.3	73.2
12/12/19 @1705	Dead Count	59					14					103	8	112	11				
	% Mortality	41%	79.6	80	72.7	75.6	8%	79.7	80.1	77	79.3	74%	5%	58%	5%	79.1	80.2	67.4	75.5
12/12/19 @1900	Dead Count	63					15					104	8	124	14				
	% Mortality	44%	78.9	79.7	74.1	77.1	8%	78.9	79.8	78.4	82.6	75%	5%	64%	7%	78.9	80	68.4	75.1
12/12/19 @2100	Dead Count	63					15					110	8	134	15				
	% Mortality	44%	78.4	78.8	75.5	78.7	8%	78.3	78.8	80.5	84.3	80%	5%	65%	7%	78.8	79.7	65.5	72.6
12/12/19 @2300	Dead Count	65					15					110	9	143	15				
	% Mortality	46%	78.3	78.4	76.9	78.7	8%	78.3	78.5	82.2	84.6	80%	6%	74%	7%	78.8	79.4	67.1	72.6
12/13/19 @0100	Dead Count	66					15					112	9	154	15				
	% Mortality	47%	78.4	78.6	77.5	79	8%	78.5	78.6	83.1	85	81%	6%	80%	7%	78.8	79.5	69.3	73.5
12/13/19 @0300	Dead Count	66					15					113	9	157	15				
	% Mortality	47%	78.5	78.9	73	78.3	8%	78.6	79.1	78.1	84	82%	6%	79%	7%	78.5	79.3	66.1	71.8
12/13/19 @0500	Dead Count	67					15					115	10	158	15				
	% Mortality	47%	78.9	79.1	72.9	74.1	8%	79.1	79.3	77.5	78.8	83%	7%	82%	7%	78.8	79.6	67.8	72.2

Spartan Mosquito Inhouse Testing

		Camera Test Tank					Camera Control Tank					Test Tank A	Control Tank B	Test Tank C	Control Tank D	Sensor # 4			
		Large Aquarium	Sensor #2				Large Aquarium	Sensor #1				Bug Dorm	Bug Dorm	Bug Dorm	Small Aquarium				
		Mortality	Temp (°F)		Humidity (%)		Mortality	Temp (°F)		Humidity (%)		Mortality	Mortality	Mortality	Mortality	Temp (°F)		Humidity (%)	
		Floor	Low	High	Low	High	Floor	Low	High	Low	High	Floor	Floor	Floor	Floor	Low	High	Low	High
12/13/19 @0700	Dead Count	[redacted]	78.9	79.1	72.9	74.1	15	79.1	79.3	77.5	78.9	[redacted]	30	[redacted]	35	78.8	79.6	67.8	72.2
	% Mortality	49%					8%					88%	7%	83%	7%				
12/13/19 @0900	Dead Count	[redacted]	79.1	79.3	73.1	74.3	15	79.1	79.3	78	79.7	[redacted]	30	[redacted]	35	79.1	79.9	68.4	72.1
	% Mortality	53%					8%					88%	7%	84%	7%				
12/13/19 @1100	Dead Count	[redacted]	79.3	79.9	71.8	74.5	17	79.3	79.8	77.6	80	[redacted]	32	[redacted]	35	78.8	80.2	66.2	74
	% Mortality	55%					9%					88%	8%	85%	7%				
12/13/19 @1300	Dead Count	[redacted]	79.6	80.2	71.8	74.8	17	79.5	80.1	77.5	80.2	[redacted]	35	[redacted]	36	79.1	80.6	66.2	74.4
	% Mortality	56%					9%					88%	10%	85%	7%				
12/13/19 @1500	Dead Count	[redacted]	80.2	80.8	73.2	75.3	17	80.2	80.8	79.1	81.3	[redacted]	38	[redacted]	35	80.6	81.3	69.1	73.6
	% Mortality	60%					9%					96%	12%	100.00%	7.27%				
12/13/19 @1700	Dead Count	[redacted]	80.8	80.9	73.5	75.9	17	80.8	81	79	81.7	[redacted]	39	[redacted]	36	81	82.2	69.2	74.1
20 alive	% Mortality	61%					9%					97.1%	13.4%		8%				
12/13/19 @1900	Dead Count	[redacted]	80.3	81	73.3	76.6	22	80.2	81.2	79.1	81.9	[redacted]	23	[redacted]	37	80.3	82.4	66.4	70.8
14 alive	% Mortality	66%					12%					100%	15%		8%				
12/13/19 @2100	Dead Count	[redacted]	79.9	80.5	74.6	76.4	22	79.8	80.5	80	82.5	[redacted]	28	[redacted]	37	80.7	80.7	66.1	70.9
10 alive	% Mortality	91%					12%						19%		8%				
12/13/19 @2300	Dead Count	[redacted]	79.8	80	74.1	76.8	22	79.7	80	78.9	82.4	[redacted]	28	[redacted]	37	80.5	81.2	65.1	69
	% Mortality	93%					12%						19%		8%				
12/14/19 @0100	Dead Count	[redacted]	79.1	79.9	73.3	75.6	23	79	80	77.4	78.5	[redacted]	30	[redacted]	38	79.7	81.1	62.9	68.4
	% Mortality	97.04%					13.04%						20%		9%				
12/14/19 @0300	Dead Count	[redacted]	79	79.4	74.1	76.6	23	79	79.5	79	81.8	[redacted]	34	[redacted]	38	79.7	80.9	65.4	69.5
	% Mortality	97%					13%						23%		9%				
12/14/19 @0500	Dead Count	[redacted]	79.5	79.7	75.4	76.5	24	79.5	79.8	80.4	81.8	[redacted]	34	[redacted]	39	80.2	81	66.4	69.4
	% Mortality	97%					14%						23%		10%				
12/14/19 @0700	Dead Count	[redacted]	79.6	79.8	74.4	75.6	24	79.6	79.8	80.1	81.8	[redacted]	34	[redacted]	39	79.7	80.3	66.4	72.7
	% Mortality	97%					14%						23%		10%				
12/14/19 @0900	Dead Count	[redacted]	79.8	79.9	75.5	74.9	24	79.8	79.9	79.2	81	[redacted]	34	[redacted]	39	79.5	80.1	69.6	73.9
	% Mortality	98.51%					13.61%						23%		10%				
12/14/19 @1200	Dead Count	[redacted]	79.8	80.1	73.5	74.7	25	79.7	80.1	79.3	80.5	[redacted]	36	[redacted]	41	79.6	80.5	69.3	73.6
	% Mortality	100%					14%						23%		11%				

Key: % Mortality is calculated as: Current dead count - last 3 dead count / total released - initial dead count

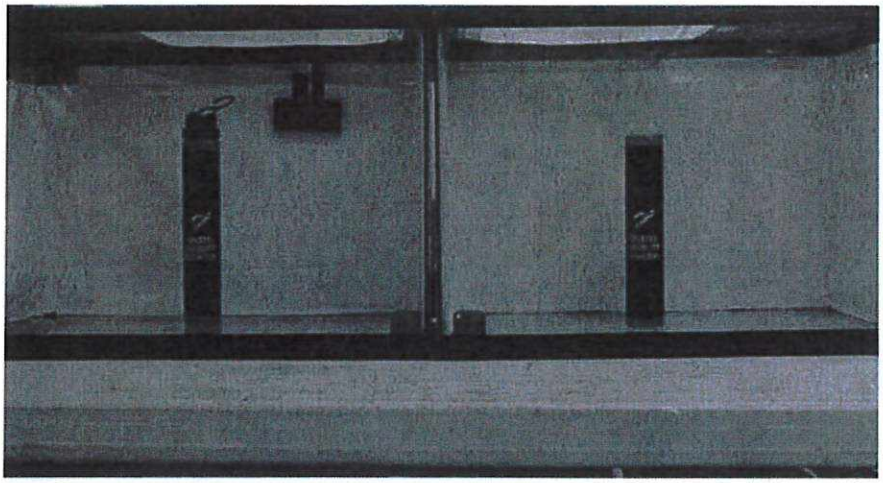
[redacted]

% Mortality used to generate Abbott's Formula

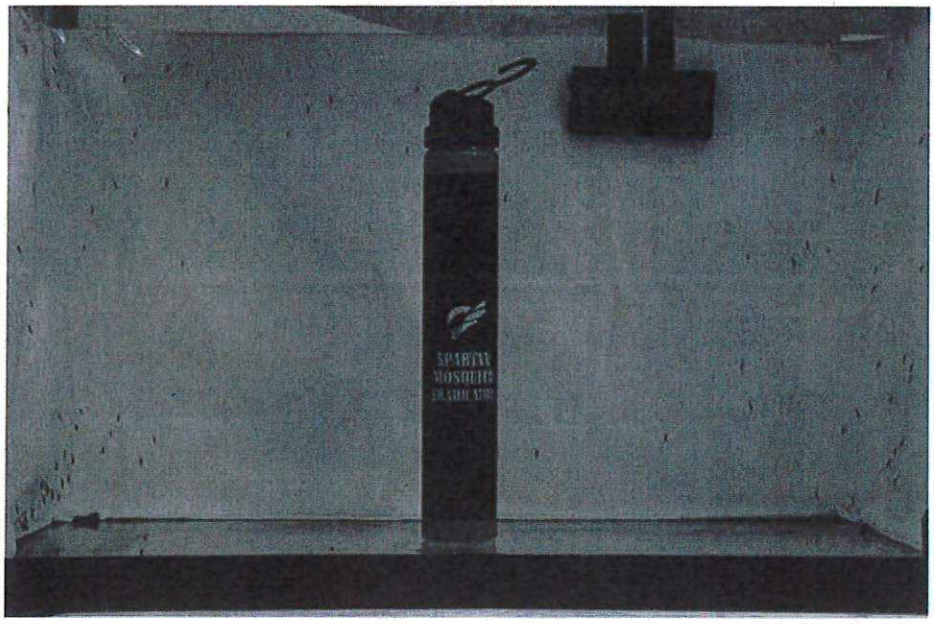
Abbott's	% Alive in control	86.39%	86.98%	92.73%	
	% Alive in Test	1.48%	2.92%	0.00%	
		98.3%	96.0%	100.0%	

Date and time of receipt at lab	12/10/19 @1011
Date and time opened box	12/10/19 @1109
Internal temperature when opened	63.7
Whats in the package	9 containers + 6 gel packs + 2 with moist paper towels + packing peanuts
Acclamation times	7 hours 15 minutes
Food source	10% sugar water in tap water
Lighting	Lights are turned off after 1800 except to do counts

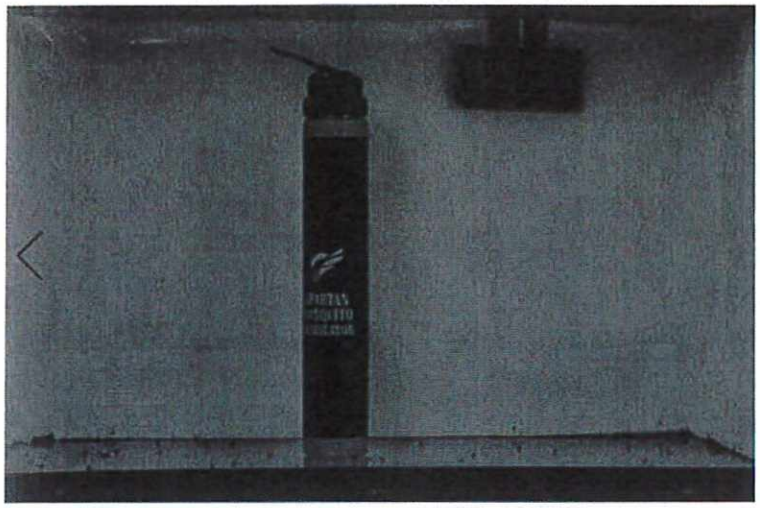
Anopheles Control and Test habitat



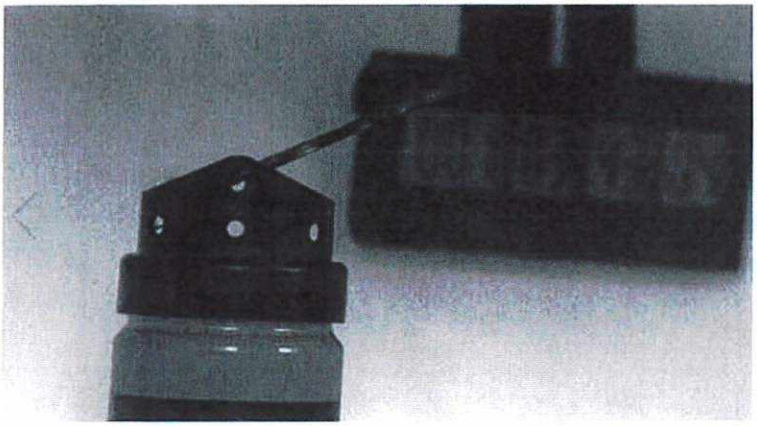
Anopheles test habitat Start



Anopheles test habitat End



Anopheles Entering Device



Certified by: _____
Michael S. Bonner, Ph.D.
Chairman of the Board

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Anopheles Inhouse Trials 12/24/19

The data provided within this paper is to provide efficacy of the use of Spartan Mosquito Pro-Tech with regards to the Anopheles quadrimaculatus.

Setup

This test was conducted using various habitats (bug dorms, large aquariums and small aquariums) in the same location while monitoring the temperature and relative humidity for mortality. On 12/24/19 at 0938, mosquitoes arrived for testing from Benzon Research. The shipping vessel contained nine cups (approximately 150 mixed sex per cup), 8 cool packs, moist towels and packing peanuts. Upon receipt the temperature and relative humidity of the inside of the vessel were measured at 53.3 °F and 63% respectively. Over the course of the next 6 hours and 45 minutes, the cups where acclimated to a temperature of 75 °F and relative humidity of 60%.

The location used for testing was monitored continuously for temperature and humidity during the duration of the test.

Procedure

A cup of mosquitoes was released into each individual habitat on 12/24/19 at 1630 and allowed to settle for thirty minutes. The six habitats included three controls with a wicked 10% sugar water in each and three product tests consisting of a Spartan Pro-Tech in each habitat. At 1700 initial mortality was observed and recorded. The initial mortality will be used later for the final calculation. For the following four days mortality counts, temperature and humidity were recorded every two to four hours.

Results

All calculations with regards to % Mortality are calculated as:

(Dead Count – Initial Mortality) / (Total Released-Initial Mortality) * 100 = % Mortality or

(B-A)/(C-A)*100 = % Mortality

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Total In Container		139				
Dead In container (not released into habitat)		1				
% Dead in Container		1%				
Total Released (into habitat)		138				
Total Released (into habitat) after Initial Mortality		135				
% Total Released		99%				
Tank Name		Camera Test Tank				
Habitat Type		Large Aquarium	Sensor #2			
A		Mortality	Temp (°F)		Humidity (%)	
		Floor	Low	High	Low	High
12/10/19 @1903	After 30 min. Initial Mortality	3	77.9	78.7	70.8	80.9
12/10/19 @2245	Dead Count	3				
	% Mortality	0%	77.5	78.5	78.2	81.2
12/11/19 @0100	B Dead Count	3				

Habitat labeled as "Camera Test Tank" and "Camera Control Tank" generated the following data.

After 90 hours the test and control yielded a % Mortality of 99.45% and 10.78% respectively.

Taking the inverse of the % Mortality to utilize **Abbott's formula**:

Eq. – (% Alive in Control - % Alive in Test) / % Alive in Control)* 100

With:

Control % Alive: 89.22%

Test % Alive: 0.55%

Abbott = 99.4% reduction.

****

Review of the Test Tank #2 and Control Tank #1, using the above equations, after 90 hours:

Control % Alive: 97.78%

Test % Alive: 2.67%

Abbott = 97.3% reduction.

****

Review of the Test Tank B and Control Tank #3, using the above equations, after 68 hours:

Control % Alive: 90.83%

Test % Alive: 0.00%

Abbott = 100% reduction

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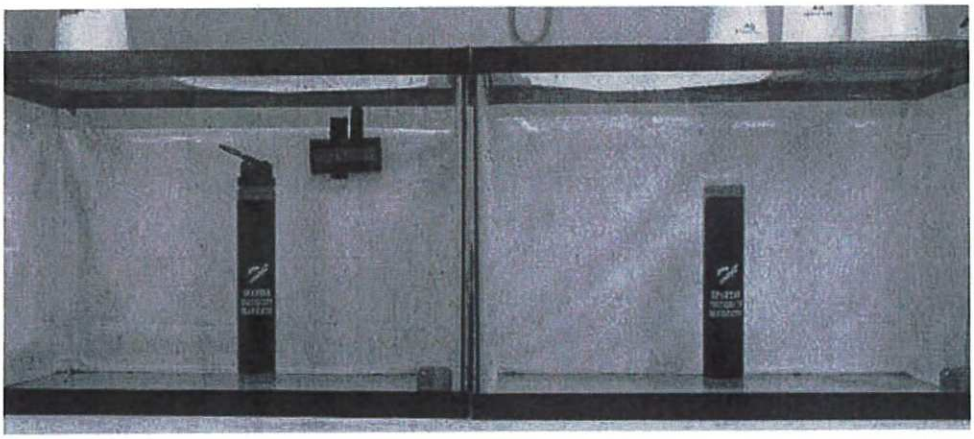
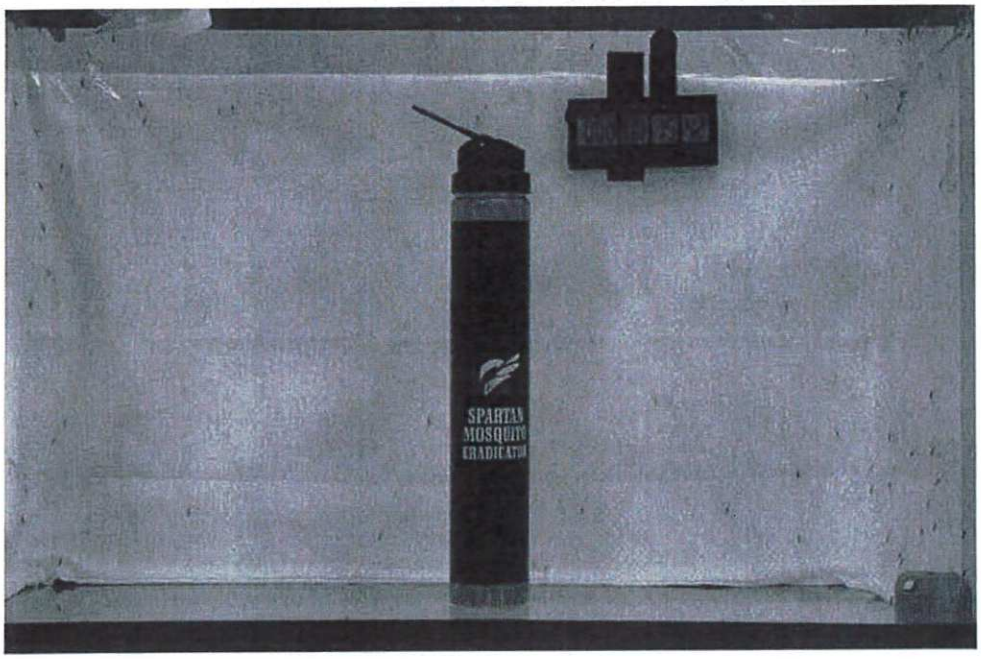
Anopheles Control and Test habitat



Anopheles test habitat Start



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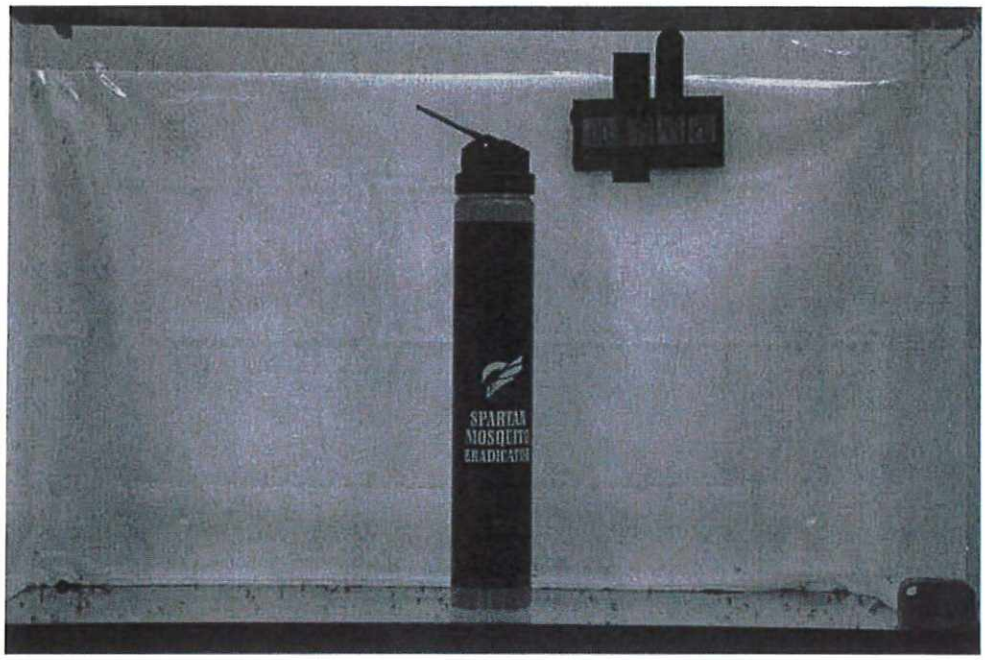
Anopheles test habitat End



Certified by: _____

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Spartan Mosquito Inhouse Testing

Anopheles quadrimaculatus

				Sensor #1						Sensor # 4			
Total in Container		148	159					124	156				
Dead in container (not released into remains)		6	6					2	5				
% Dead in Container		4%	4%					2%	5%				
Total Released (into habitat)		142	153					122	103				
Total Released (into habitat) after Initial Mortality		135	150					120	103				
% Total Released		95%	96%					98%	95%				
Tank Name		Control Tank #1	Test Tank #2					Control Tank #3	Test Tank B				
Habitat Type		Small Aquarium	Small Aquarium					Small Aquarium	Bug Dorm				
		Mortality	Mortality	Temp (°F)		Humidity (%)		Mortality	Mortality	Temp (°F)		Humidity (%)	
		Floor	Floor	Low	High	Low	High	Floor	Floor	Low	High	Low	High
12/24/19 @1700	After 30 min. released	7	3	75.2	76.9	58.4	69.9	2	0	73.5	76.6	67.4	82.9
12/25/19 @1500	Dead Count	7	19					2	1				
	% Mortality	0%	11%	75.2	76.5	65.3	65.8	0%	1%	74.9	76.3	75.9	92.9
12/25/19 @1800	Dead Count	7	24					2	7				
	% Mortality	0%	14%	76.1	76.5	64.2	68.4	0%	7%	74.1	75.4	77	82.5
12/25/19 @2300	Dead Count	7	33					4	7				
	% Mortality	0%	20%	75.8	76.1	68.3	69.5	2%	7%	73.8	74.5	78.8	83.5
12/26/19 @1000	Dead Count	7	67					5	10				
	% Mortality	0%	43%	76	76.7	69	69.6	3%	10%	73.8	76	80.5	86
12/26/19 @1300	Dead Count	8	74					5	13				
	% Mortality	1%	47%	75.2	77.2	69	80.5	3%	13%	76.1	80.6	59.8	83.1
12/26/19 @2200	Dead Count	8	93					7	25				
	% Mortality	1%	60%	76.3	78	75.9	80.3	4%	24%	76	81.1	59.7	76.8
12/27/19 @1000	Dead Count	9	131					10	55				
	% Mortality	1%	85%	76.4	76.8	75.9	77.1	7%	53%	75.3	76.6	70.2	75.1
12/27/19 @1100	Dead Count	9	138					12	54				
	% Mortality	1%	90%	76.5	76.8	77.2	79	8%	52%	76.4	77	73	79.4
12/27/19 @1500	Dead Count	9	115					12	70				
	% Mortality	1%	75%	76.7	77	77.7	78.4	8%	59%	75.4	76.9	76.3	84.6
12/27/19 @2100	Dead Count	9	134					13	70				
	% Mortality	1%	87%	76.2	76.6	75.4	78	9%	68%	75.2	80.2	55.8	84.6
12/28/19 @1030	Dead Count	10	140					11	103				
	% Mortality	2.22%	97.33%					9.17%	100%				

Total in Container		196					104				
Dead in container (not released into remains)		10					1				
% Dead in Container		5%					1%				
Total Released (into habitat)		186					103				
Total Released (into habitat) after Initial Mortality		182					102				
% Total Released		95%					99%				
Tank Name		Camera Test Tank					Camera Control Tank				
Habitat Type		Large Aquarium	Sensor #2				Large Aquarium	Sensor #3			
		Mortality	Temp (°F)		Humidity (%)		Mortality	Temp (°F)		Humidity (%)	
		Floor	Low	High	Low	High	Floor	Low	High	Low	High
12/24/19 @1700	After 30 min. released	4	74.3	75.8	65.9	82.8	1	75.2	76.7	60.3	74.3
12/25/19 @1500	Dead Count	10					2				
	% Mortality	3%	75.1	75.8	79.7	83	1%	76.7	77.1	73.1	74.2
12/25/19 @1800	Dead Count	17					2				
	% Mortality	7%	75.2	75.8	78.9	79.6	1%	76.2	76.9	73.1	73.4
12/25/19 @2300	Dead Count	23					3				
	% Mortality	10%	75	75.2	78.3	79.2	2%	76	76.3	73	73.4
12/26/19 @1000	Dead Count	59					4				
	% Mortality	30%	75.1	76.2	78.1	79.9	3%	76.3	77.5	72.7	73.6
12/26/19 @1300	Dead Count	68					3				
	% Mortality	35%	74.6	77.8	78.2	92.3	2%	77	78.6	73.8	77.8
12/26/19 @2200	Dead Count	82					3				
	% Mortality	43%	77.8	79.4	57.9	90	2%	78	80.1	66.5	74.7
12/27/19 @1000	Dead Count	96					4				
	% Mortality	51%	77.4	77.5	57.2	67.5	3%	77.2	77.5	65.7	66.7
12/27/19 @1100	Dead Count	108					5				
	% Mortality	57%	77.6	78.1	57.9	68.5	4%	77.9	78.6	66.5	67.8
12/27/19 @1500	Dead Count	119					5				
	% Mortality	63%	77.8	78.2	57.2	67.8	4%	78.2	78.6	66.4	67.8
12/27/19 @2100	Dead Count	132					8				
	% Mortality	70%	77.2	77.9	63.4	67.6	7%	77.6	79.6	55	67.1
12/28/19 @1030	Dead Count	181					11				
	% Mortality	99.45%					10.78%				

((X-Y)/X*100

Abbott's				
% Alive in control	97.78%	90.83%	89.22%
% Alive in Test	2.67%	0.00%	0.55%
	97.3%	100.0%	99.4%

Key
% Mortality is calculated as: Current dead count - initial dead count / total released - initial dead count
Does not include mosquitoes in the tube
Final numbers/Test done
% Mortality used for Abbott's

Date and time of receipt at lab	12/24/19 @0938
Date and time opened box	12/24/19 @0945
Internal temperature when opened	53.3
Whats in the package	9 containers - 6 gel packs - 2 with moist paper towels - packing peanuts
Acclamation times	7 hours 15 minutes
Food source	10% sugar water in tap water
Lighting	Lights are on all the time