CMMCP AERIAL MOSQUITO LARVAL CONTROL PROGRAM

SPRING 2016

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ABSTRACT

To reduce the volume of numerous early summer mosquito species, the Central Massachusetts Mosquito Control Project performed a focused aerial application of Bacillus thuringiensis israelensis in the member communities of Billerica, Boxborough, and Chelmsford. This event took place over the course of two consecutive days, the 20th and 21st of April 2016, covering approximately two thousand acres of wetlands inundated with mosquito larvae. Observation of these larvae conducted prior to and following the aerial larvicide, showed an average reduction of 86.36% for each surveillance site. This decrease in larvae will reduce the level of pestiferous, mammal-biting adult mosquitoes and lessen the need for ultra-low volume adulticiding during the summer months.

OBJECTIVE

The primary mosquito species targeted in this aerial application were *Ochlerotatus abserratus*, *Ochlerotatus excrucians*, and *Ochlerotatus canadensis*. The eggs of these mosquitoes overwinter in the temporary snow pools, and upon spring snow melt, will hatch into larvae and begin to develop. *Ochlerotatus abserratus* and *Ochlerotatus excrucians* are both univoltine species, meaning they only have one generation per season, with any eggs laid by adult female mosquitoes not hatching until the following year. Conversely, *Ochlerotatus canadensis* is considered a multivoltine mosquito species that has the ability to produce more than one generation a season. This particular species has also shown the ability to harbor mosquito-borne diseases such as West Nile virus and Eastern Equine Encephalitis (Andreadis 2005). If successful, this type of aerial larvicide will reduce the need for adulticiding these pestiferous species upon emergence and also diminish a potential vector of mosquito-borne disease.

METHODS AND MATERIALS

VectoBac G® (EPA Reg. No. 73049-10) is the formulation of Bacillus thuringiensis israelensis used in this aerial larvicide program, as well as the CMMCP ground larvicide program (CMMCP 2016). Originally registered in 1961, Bacillus thuringiensis is a naturally occurring bacterium that produces target specific toxins when ingested. This asexually reproducing soil bacterium produces spores, as well as crystalline byproducts. It are these crystals which interfere with the digestion of the targeted insect species, eventually leading to mortality. Bacillus thuringiensis readily breaks down when applied into the environment, and poses no threats to groundwater (Extension Toxicology Network 1996; National Pesticide Information Center 2015).

North Fork Helicopter (Cutchogue, New York) was contracted once again to facilitate the application of this aerial

larvicide program. The Billerica and Chelmsford portions of the program were conducted on April 20th, with Boxborough the following day. Warren Farm in Chelmsford was utilized as the staging area on the first application day, with Minute Man Airfield in Stow being used for the second and final day. CMMCP personnel identified specific wetlands bearing mosquito larvae, which North Fork Helicopter was then able to target and treat with VectoBac G®. Approximately two thousand total acres were treated in this program, or 600, 520, and 880 acres between Billerica, Chelmsford and Boxborough respectively. This aerial larvicide program utilized a 5lbs/acre application rate. Historically this application rate of VectoBac G® has provided proper control in these areas.

To evaluate the efficacy of this and other aerial larvicide events in the Commonwealth of Massachusetts, the Generic Environmental Impact Report (GEIR) outlines the formation of recoverable dip stations (RDS). For each town involved in the aerial larvicide program, one RDS is needed for every 250 acres treated as well as one control RDS located in an untreated area. Ten flagged locations at each RDS are sampled for larvae, before treatment, at 24 hours post application and 48 hours post application. Larval density changes among these observations are the basis for determining the level of control achieved for the aerial larvicide program. Sampled larvae are always returned to ensure that the treatment and control observations are not artificially impacted, however, larvae are retrieved from non-flagged locations in each RDS to obtain information on the mosquito species present at the time of application. Following the larvicide event, the presence or absence of VectoBac G® is also noted in addition to the larval density (Massachusetts Department of Agricultural Resources 1998). As per 333CMR 13.04 (7) a legal notification of the aerial larvicide was placed in The Boston Globe on February 10th, 2016, and also posted on the CMMCP website (http://www.cmmcp.org/) (Appendix A).

RESULTS

On average, the treatment RDS of Billerica, Boxborough, and Chelmsford experienced an 86.36% reduction in larvae following the 2016 spring aerial larvicide. Individually, the Billerica RDS exhibited an average reduction of 88.94%, while an average reduction of 80.28% and 91.88% was observed for Boxborough and Chelmsford respectively. The untreated (control) RDS of the three communities averaged a 7.32% decrease in larvae from the beginning of the program (Table 1; Figures 1-3).

Table 1: Larval Surveillance of Treatment and Control RDS

Treatment Sites	Pre-application	Post-application	Observed Change
BIL116	71	7	-90.14%
BIL112	56	1	-98.21%
BIL408	65	14	-78.46%
BOX128	23	0	-100.00%
BOX118	30	7	-76.67%

BOX92	24	0	-100.00%
BOX121	27	15	-44.44%
CHM82	53	2	-96.23%
CHM279	44	7	-84.09%
CHM236	64	3	-95.31%
Control Sites	**Pre-application**	**Post-application**	**Observed Change**
BIL227	50	62	24.00%
ACT37	62	58	-6.45%
CHM146	124	75	-39.52%

Figure 1: Billerica Treatment RDS Results Pre- and Post Application

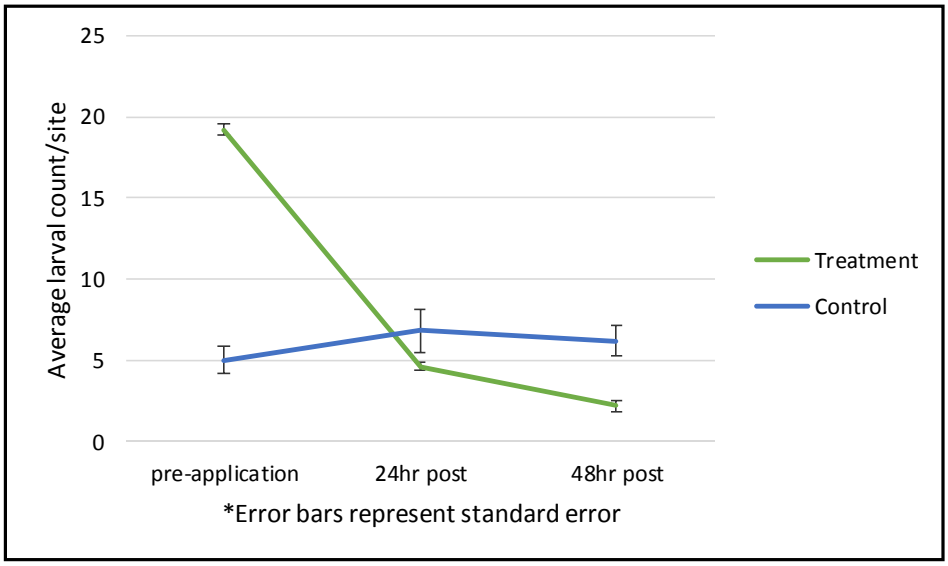


Figure 2: Boxborough Treatment RDS Results Pre- and Post Application

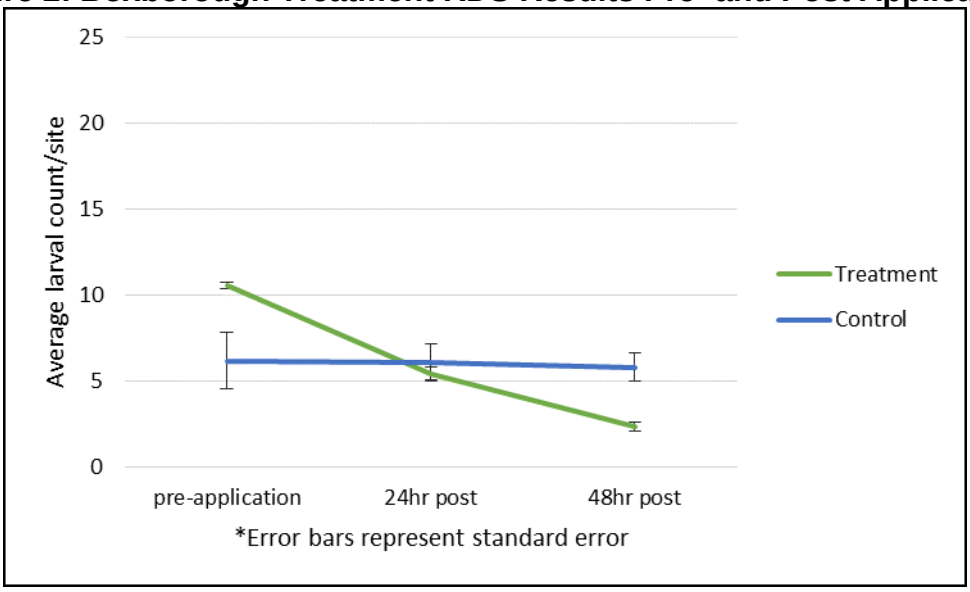
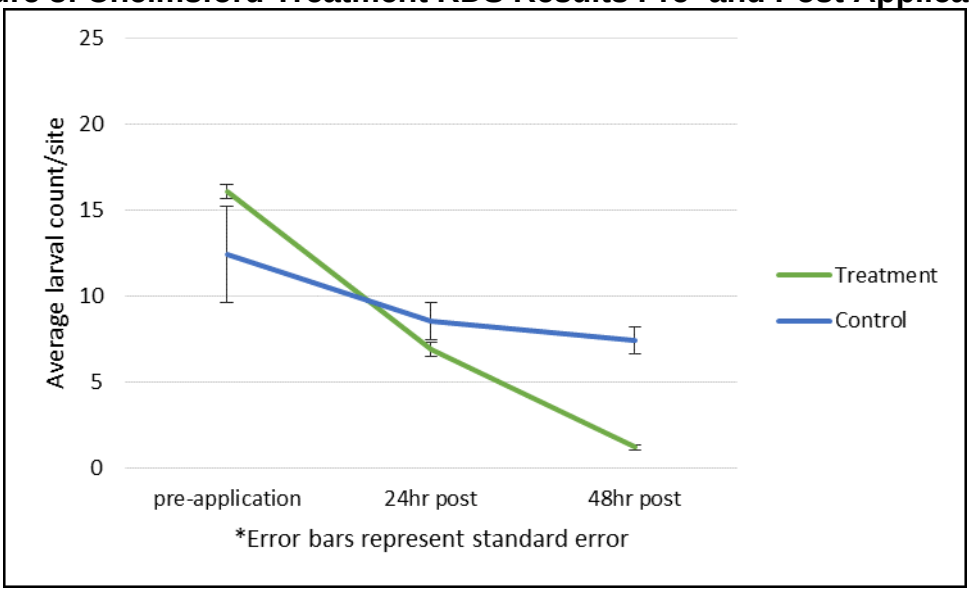


Figure 3: Chelmsford Treatment RDS Results Pre- and Post Application



DISCUSSION

Every spring, upon the detection of early season mosquito larvae, CMMCP field technicians begin to apply Bacillus thuringiensis israelensis to reduce the eventual emergence of adults. For locations in Billerica, Boxborough, and Chelmsford that are too massive and inundated to larvicide by hand, CMMCP may opt for treatment through the aerial larvicide program. In 2016, this application event occurred over two days, April 20th and 21st. Larval surveillance was conducted prior to the aerial larvicide, and twice following the treatment. With an average larval reduction of 86.36%, the 2016 CMMCP spring aerial experienced measured success. Conversely, the untreated control sites had an average reduction of only 7.32%, which is consistent with previous CMMCP aerial larvicide events.

Through the observed reduction of *Oc*. *abserratus*, *Oc*. *excrucians* and *Oc*. *canadensis* mosquito larvae, the residents of Billerica, Boxborough, and Chelmsford will experience diminished pressure from the early summer adults of these three mosquito species. Additionally, the need for adulticiding in these areas will be lessened because of the control achieved in this program. CMMCP will incorporate this years' experience into the design and implementation of future aerial larvicides events. This includes the potential expansion of the program into additional CMMCP member communities.

ACKNOWLEDGEMENTS

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site selection, map development and assisting with the helicopter application. An additional thanks goes to Nate Boonisar of the Norfolk County Mosquito Control District for his assistance once again with creating target files for the helicopter navigation system.

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The Boston Globe

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NOTICE PREVIEW:

Legal Notice - Aerial Application to Control Mosquito Larvae
Per 333CMR 13.04(7), the Central Mass. Mosquito Control and North Fork Helicopters will be conducting helicopter applications of the biological larvicide Bti to control mosquito larvae over selected wetlands in the towns of Boxborough, Billerica and Chelmsford. The applications will be conducted during the daylight hours from March 1 to October 31, 2016 as conditions warrant. The trade name of the product to be used is Vectobac G (EPA Reg. #73049-10). For additional information please contact Tim Deschamps at (508) 393-3055.