Mitigation Techniques for Mosquitoes in Rainwater Harvesting Systems

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Background

- Rainwater harvesting (RWH) involves collecting runoff from rooftops and storing it for later use; it is a useful stormwater management and water conservation tool when maintained[1]
- Previous research has shown that RWH storage tanks can provide an ideal breeding location for mosquitoes if they are unused and/or unmaintained due to stagnant, standing water in the storage tank[2]
- This is a public health concern because mosquitoes are vectors for disease[3]


Rainwater harvesting system


Standing water inside RWH storage tank

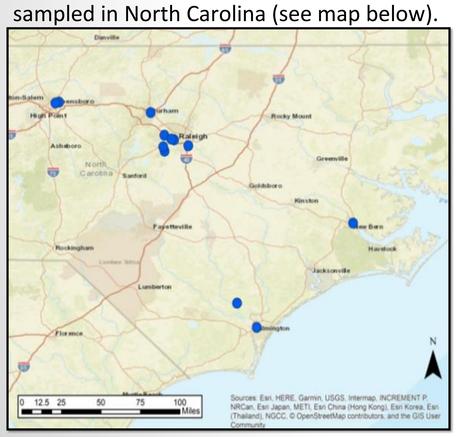

Adult mosquito resting inside storage tank

Research Question

Which mitigation technique is most effective in reducing mosquitoes in rainwater harvesting systems?

Methods

Twelve sites, a total of 20 RWH systems, were sampled in North Carolina (see map below).



For each sampling visit:

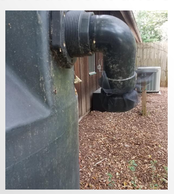

Larval traps were deployed for 24 hours in the storage tank


Gravid and BG adult traps were deployed for 24 hours outside the tank


Collected larval and adult specimens were ID'ed to genus and species

Four treatments were selected for this study. Treatments were assigned to RWH systems randomly, with each treatment implemented at four systems. Four systems received no treatment and served as the control.


Automated valve timed to drain storage tank every 7 days

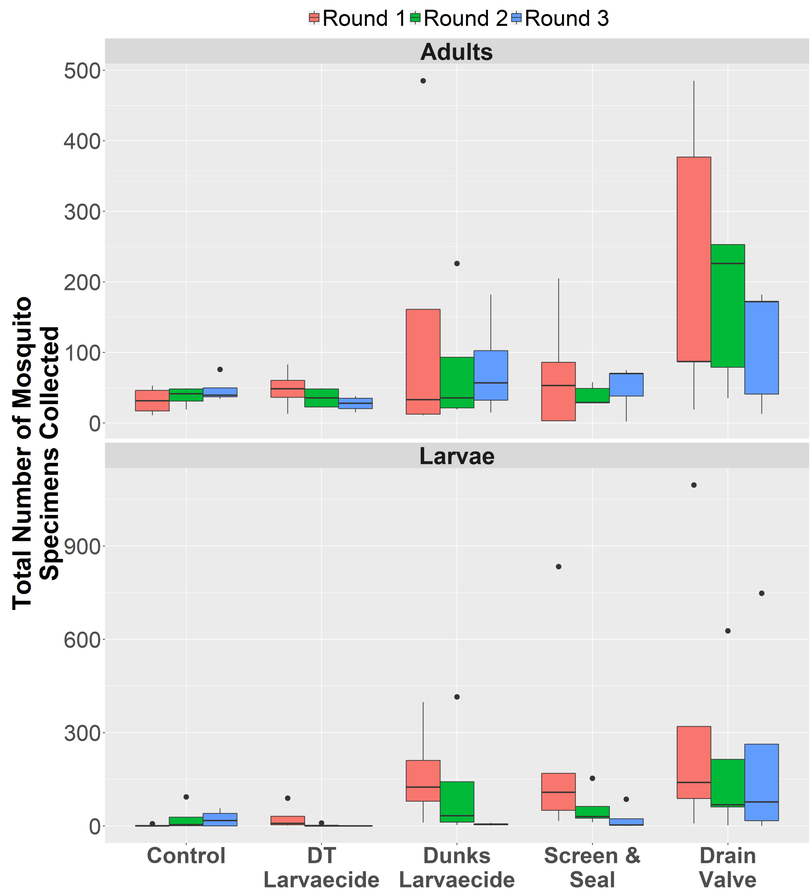

Screening and sealing all potential entries to internal part of the tank

Natular® DT larvicide tablets applied to storage tank

Mosquito Dunks® larvicide applied to storage tank

Sites were sampled once in late May, treatment was applied, and sites were sampled twice more in July and August.

Results and Discussion



The figure to the left summarizes the results of the 3 rounds of sampling. Several outcomes were noted:

- The number of larvae captured within storage tanks of RWH systems were significantly lower post-treatment for DT Larvicide, Mosquito Dunks, and Screen & Seal treatments.
- The number of larval specimens captured at control sites and those employing a drain valve did not change significantly pre- and post-treatment.
- The number of adults captured in the environment surrounding the sampled storage tanks did not change significantly over the study period, except for the sites receiving the DT Larvicide, where the number of specimens collected during Round 3 was significantly less than Round 1.
- An error in deployment of Mosquito Dunks likely caused the higher number of larvae collected during Round 2. Dunks were not initially deployed in a manner that allowed them to float, which is necessary for proper treatment. The deployment method was modified after Round 2 and Round 3 results showed a significant decrease.
- The drain valve, which drains the storage tank every 7 days, was the only treatment tested that did not result in a significant decrease in the number of larvae collected from storage tanks by Round 3.

Conclusions

- Natular® DT Larvicide tablets were the only treatment that resulted in zero larvae being collected from the storage tanks during Round 3.
- The 3 treatments that resulted in statistically significant decreases in the number of mosquito larvae captured from RWH storage tanks were Natular® DT Larvicide tablets, Mosquito Dunks Larvicide, and screen/sealing openings in the tank.
- Screening and sealing was not as effective as the larvicides because mosquito eggs and larvae could still be washed into tanks from the gutters and survive within the storage tank; however, adult mosquitoes can not exit tanks, which prevents breeding and removes the human health threat.
- Draining once a week was least effective and did not significantly reduce the number of larvae collected. This is likely because water remains in the tank even after draining; the tank outlet is positioned approximately 2 inches above the bottom of the tank.
- While larvicides were clearly the most effective method of mitigating the presence of mosquito larvae in RWH storage tanks, concerns regarding their safety and cost could prevent RWH owners from utilizing them.

Acknowledgements & References

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