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Combined manipulation of leaf litter and microbial larvicide enhances local control of Culex mosquitoes

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Combined manipulation of leaf litter and microbial larvicide enhances local control of *Culex* mosquitoes

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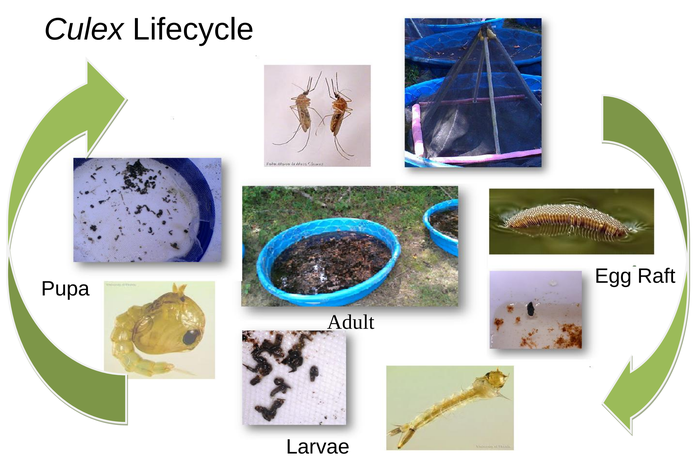
Introduction

Bacillus thuringiensis israelensis (Bti) is a naturally occurring insect pathogen widely used as a microbial larvicide for mosquito control. Bti both produces proteins which kill mosquito larvae and can deter oviposition by female mosquitoes.

While deterring oviposition can reduce local mosquito production, these eggs may be redirected to other suitable habitats and contribute to adult recruitment at the landscape scale. In contrast, larval mortality reduces both local and regional recruitment. **To maximize mosquito control across spatial scales, we should attract rather than deter oviposition to Bti treated habitats, creating mosquito "sinks".**

Study Design



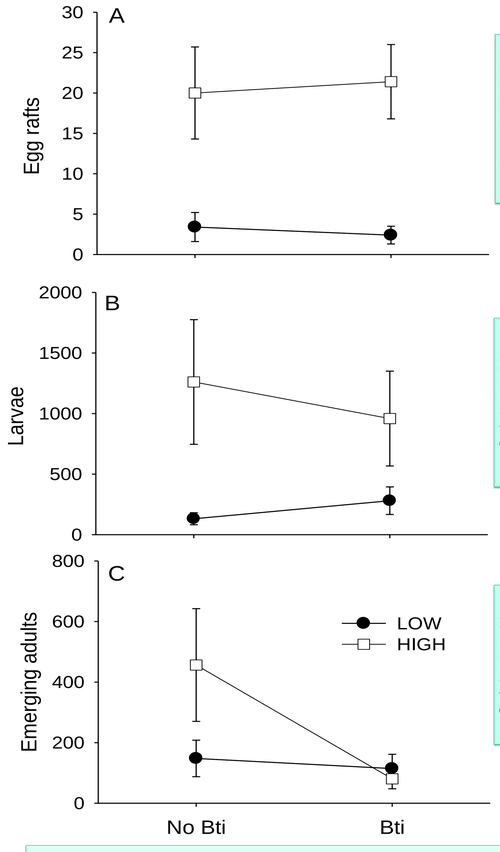
We conducted a 2 x 2 factorial field mesocosm experiment in which we manipulated **litter abundance** and **Bti presence** and quantified *Culex* spp. mosquito **oviposition**, **larval abundance**, and **adult emergence**. Each treatment was replicated 7 times in 300 L aquatic mesocosms arrayed at the VCU Rice Center.

Hypothesis

As mosquitoes often preferentially deposit eggs in aquatic habitats rich in organic matter, **we hypothesize that increasing leaf litter to attract oviposition will increase the efficacy of Bti treatment.**

Results/Discussion

Bti had no effect on mosquito oviposition or larval abundance. In contrast, increasing leaf litter 50% resulted in a fivefold increase in egg rafts and mosquito larvae.

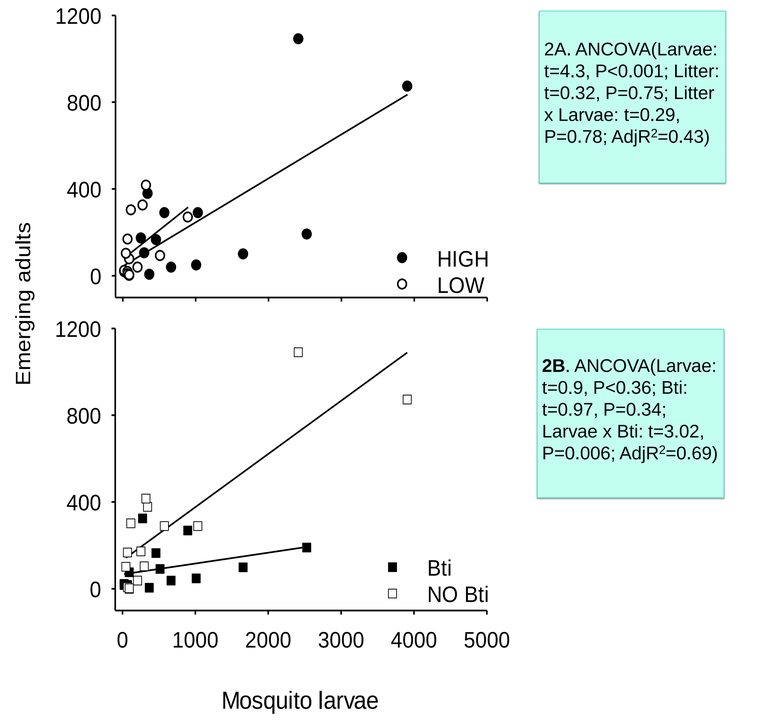


1A. Poisson glm (Bti: X^2=0.03, P=0.87; Litter: X^2=211.0, P<0.001; Bti x Litter: X^2=1.5, P=0.22; BLK: X^2=26.0 P<0.001, deviance explained =61%)

1B. Poisson glm (Bti: X^2=62.2, P=0.76; Litter: X^2=9552.2, P<0.001; Bti x Litter: X^2=613.4, P=0.34; BLK: X^2=1803.6 P=0.111, deviance explained =47%)

1C. Poisson glm (Bti: X^2=1539.4, P<0.005; Litter: X^2=673.9, P<0.05; Bti x Litter: X^2=525.0, P=0.08; BLK: X^2=506.0 P=0.09, deviance explained =47%)

The effect of Bti on adult emergence depended upon leaf litter. Bti reduced emergence by 75% in high litter treatments, but had no effect in low litter treatments.



2A. ANCOVA(Larvae: t=4.3, P<0.001; Litter: t=0.32, P=0.75; Litter x Larvae: t=0.29, P=0.78; AdjR^2=0.43)

2B. ANCOVA(Larvae: t=0.9, P<0.36; Bti: t=0.97, P=0.34; Larvae x Bti: t=3.02, P=0.006; AdjR^2=0.69)

Conclusion

High litter combined with Bti application increased mosquito colonization fivefold but produced no more adults than low litter treatments.

Thus, even though we found no evidence that Bti deterred oviposition, attraction to litter resulted in increased efficacy of Bti application.

Our results suggest a potential cost effective, chemical insecticide free approach to enhanced mosquito control.

Acknowledgements

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