Suppression of Host-Seeking Ticks and Relevance to Human Health: Standard Pesticides

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Integrated Tick Management Symposium: Solving America’s Tick-Borne Disease Problem
Washington, D.C.

May 16, 2016
Synthetic pesticide applications

- Granules
- Sprays
  - High pressure, high volume
  - Low pressure, low volume
- Restrictions
  - Water
  - Vegetable gardens
  - Select ornamentals
Pesticides evaluated

- Organophosphates
  - Chlorpyrifos
  - Diazinon
- Pyrethroids
  - Bifenthrin
  - Cyfluthrin
  - Deltamethrin
- Carbaryl
Entomologic studies\textsuperscript{1,2} of synthetic acaricide efficacy in \textbf{woodland} settings (optimal)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Application method</th>
<th>References</th>
<th>%Reduction</th>
<th>Sites (n)</th>
<th>Timing of eval</th>
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<td>Bifenthrin</td>
<td>Spray</td>
<td>2010 Rand</td>
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\textsuperscript{1}Effect on nymphal tick populations
\textsuperscript{2}Spring/Early summer applications
Entomologic studies\(^1,\)\(^2\) of synthetic acaricide efficacy in residential settings (less optimal)

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\(^1\)Effect on nymphal tick populations  
\(^2\) Spring/Early summer applications
Barrier pesticide application

- Recommended by entomologists, public health agencies
- Target ecotone between human and tick occupied habitat
- In 2003 survey, 29% of 2,400 Connecticut households reported using pesticides in previous year to control ticks

...but do they prevent tickborne illness?

Lyme and other tickborne diseases prevention study

- Randomized, blinded, placebo-controlled trial (CT, MD, and NY)
- 2,727 households (.5 – 5 acre properties) surveyed and randomized to receive single barrier application
  - pesticide (bifenthrin)
  - placebo (water)
- Applications
  - May 1-June 15 using backpack or truck sprayers
  - lawn/brush border per industry practice
Study outcomes

- Entomologic: 10% of properties (n=267) flagged for questing ticks 3-4 weeks post-treatment

- Human:
  - Ticks crawling and attached (ascertained through 4 monthly web-based surveys)
  - Final survey for physician-diagnosed tickborne disease during study periods
  - Medical records to validate illness reports
Enrollment and completion

4,459 Assessed for Eligibility

Enrolled 2,727 Households

Pesticide 1362

Completed 1273 (93%)

Placebo 1365

Completed 1268 (93%)

Ineligible/ 89 withdrawn 97
Acaricide trial outcome by treatment group

- Questing Ticks: 
  - Placebo: 100
  - Pesticide: 40
  - p = 0.02*

- Ticks Crawling: NS

- Ticks Attached: NS

- TBDs Reported: NS

*Based on a one-sided Wilcoxon Rank Sum test
Findings

- Many properties excluded due to water
- Randomization and blinding worked well
- 63.4% fewer ticks on pesticide-treated properties
  - 68.8% in 2011
  - 45.1% in 2012
- Human illness and tick encounters not similarly reduced
Possible reasons for lack of effect on human outcomes

- Spraying does not include all high risk areas
- Most exposures outside of immediate yard
- Non-linear relation between tick abundance and human exposure
  - “tick-prone” people?
  - tick reduction threshold?
Summary – synthetic pesticides

- Synthetic pesticides work well to kill ticks
- Residential barrier spray did not protect people from tick encounters or tickborne diseases
- We need to change how/where they are used to protect people
- Commonly used entomologic outcomes (e.g., tick drags) are not sufficient by themselves for assessing effectiveness
Acknowledgments

Connecticut Emerging Infections Program
Connecticut Department of Public Health
School of Public Health at Yale University
James Meek       Sara Niesobecki
Julie Ray       Neeta Connally

Maryland Emerging Infections Program
Maryland Department of Health and Mental Hygiene
Katherine Feldman   Erin Jones
Heather Rutz       S.B. Wee

New York State Emerging Infections Program
New York Department of Health
Bryon Backenson   Jennifer White
Wilson Miranda    Gary Lukacik
Nadia Thomas

U.S. Army Center for Health Promotion and Preventive Medicine, Entomological Sciences Program
Ellen Stromdahl

ORKIN
Sarah Robinson   Ron Harrison
Branch Managers and Staff
Acknowledgments

CDC
Division of Vector-Borne Diseases
Paul Mead         Ashley Kay         Joe Piesman         Marc Dolan
John Jones        Ben Beard          Sarah Hook

National Center for Emerging and Zoonotic Infectious Diseases, Office of the Director
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1-800-CDC-INFO (232-4636)

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