Estimating Monitoring Trap Plume Reach and Trapping Area for Nymphal and Adult BMSBs

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Collaborating Institutions

ars · NC State University · PennState · OSU Oregon State · University of Maryland · University of Georgia · Washington State University · Northeastern IPM Center · Cornell University · Utah State University · Rutgers University · The Ohio State University · University of Kentucky · UC Davis · University of Minnesota · Virginia Tech · Berkeley · Michigan State University · UC Riverside

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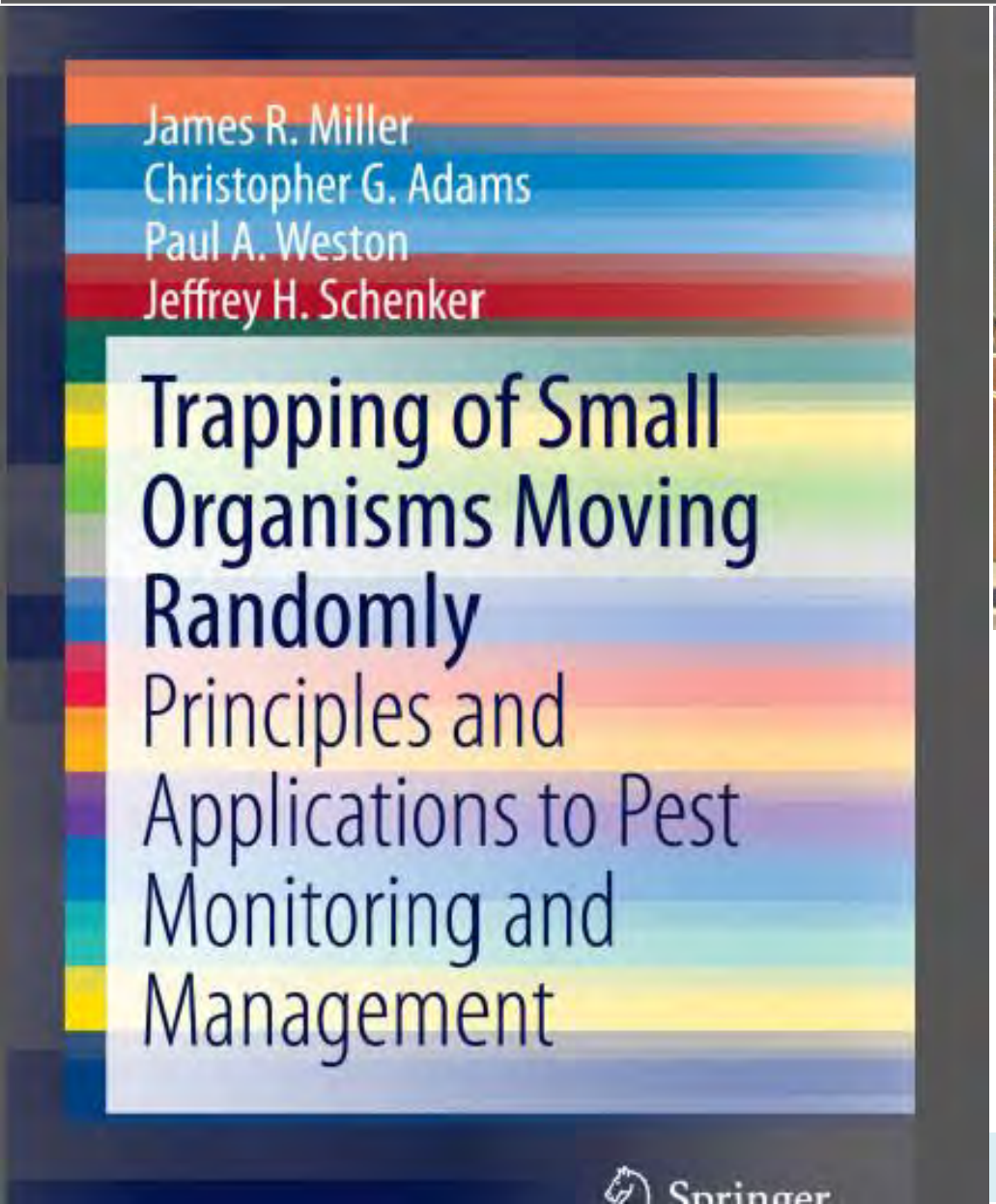
Sensitive and Reliable Trap-Based Monitoring System

- Clear sticky panel traps baited with 5:50 mg (Pheromone:MDT) lures from Trece.
- Captured adults and nymphs reliably at low, moderate or high population levels.
- Trap is less expensive and easier to deploy.
- Evaluated across the USA.
- Acebes-Doria et al. (in prep).

Key Question

- Over what area does a single trap reliably sample and capture foraging BMSB adults and nymphs?

Trapping Theory



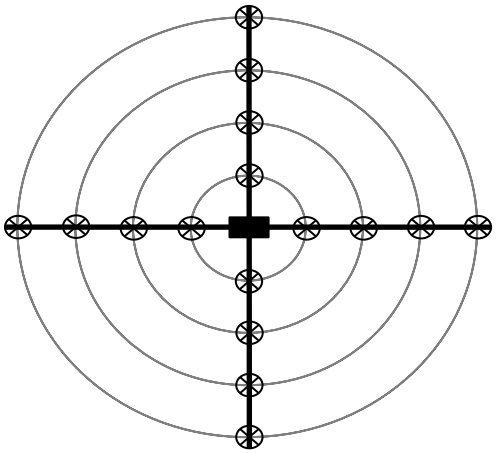
Theory developed using the Weston Multi-Mover Program

Key variables controlled:

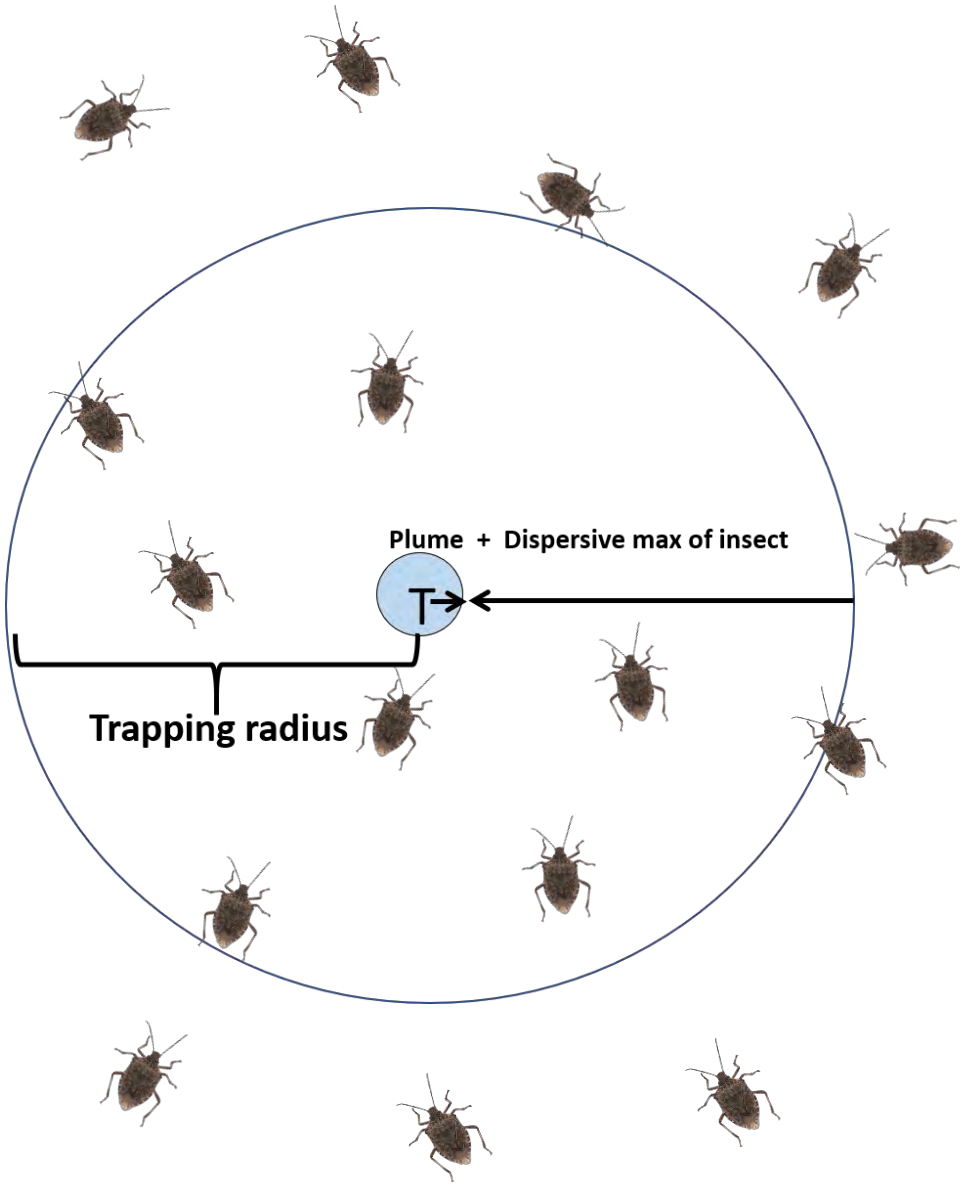
- *Turn angle of random movers*
- *Number of movers*
- *Size of trap and plume*
- *Variable time*

Trapping Theory and Field Validation

Adams et al. *Journal of Economic Entomology* (2017)



Trapping area of a pheromone-baited trap?



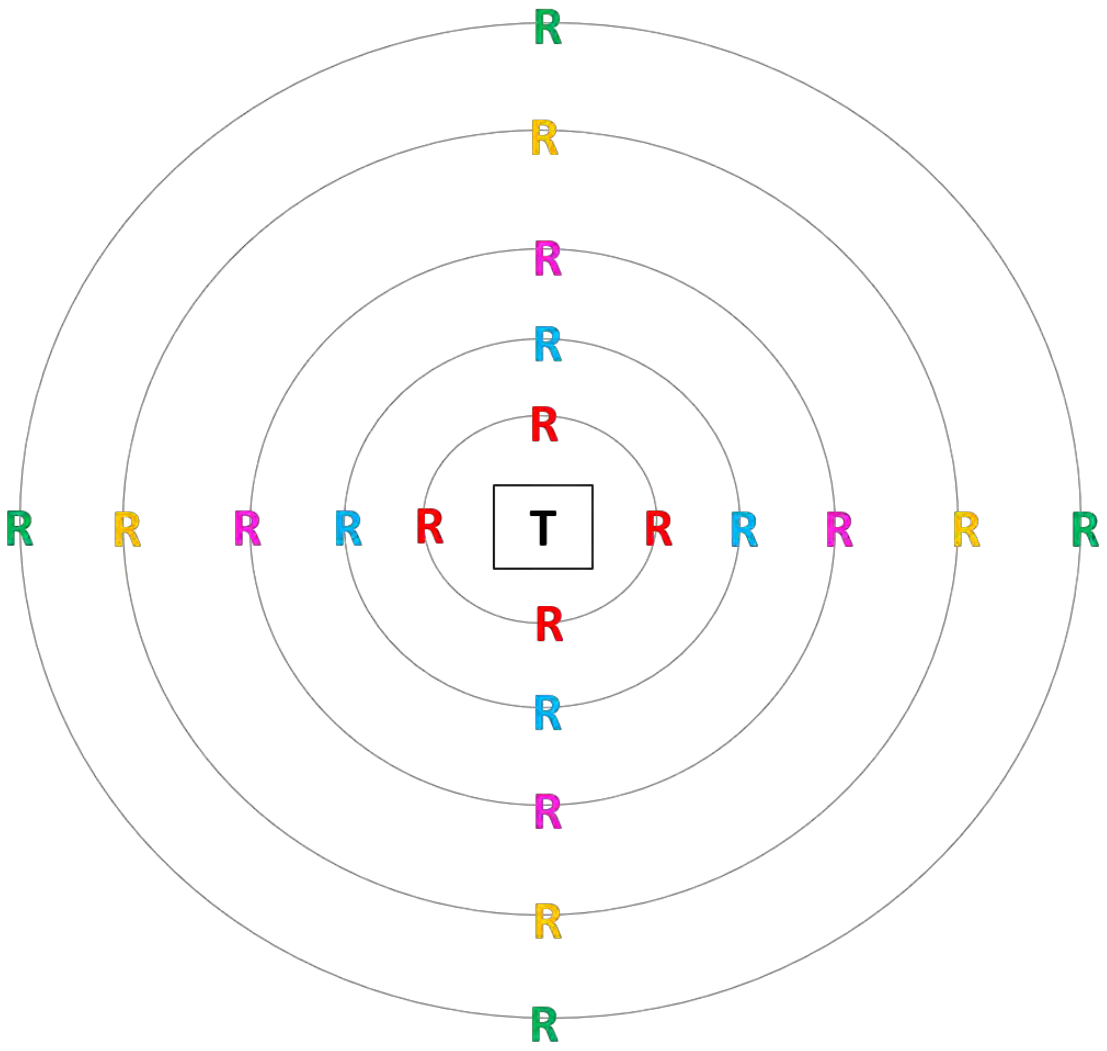
Plume reach
Distance from a baited trap that elicits a behavioral response from an insect randomly foraging through the environment.

Maximum Dispersive Distance
Furthest distance from which 95% of the population can reach the trap

Trapping radius
Longest distance from the trap that can yield captures of target individuals

Trapping area
Circular area around the trap over which a single trap can capture target insects

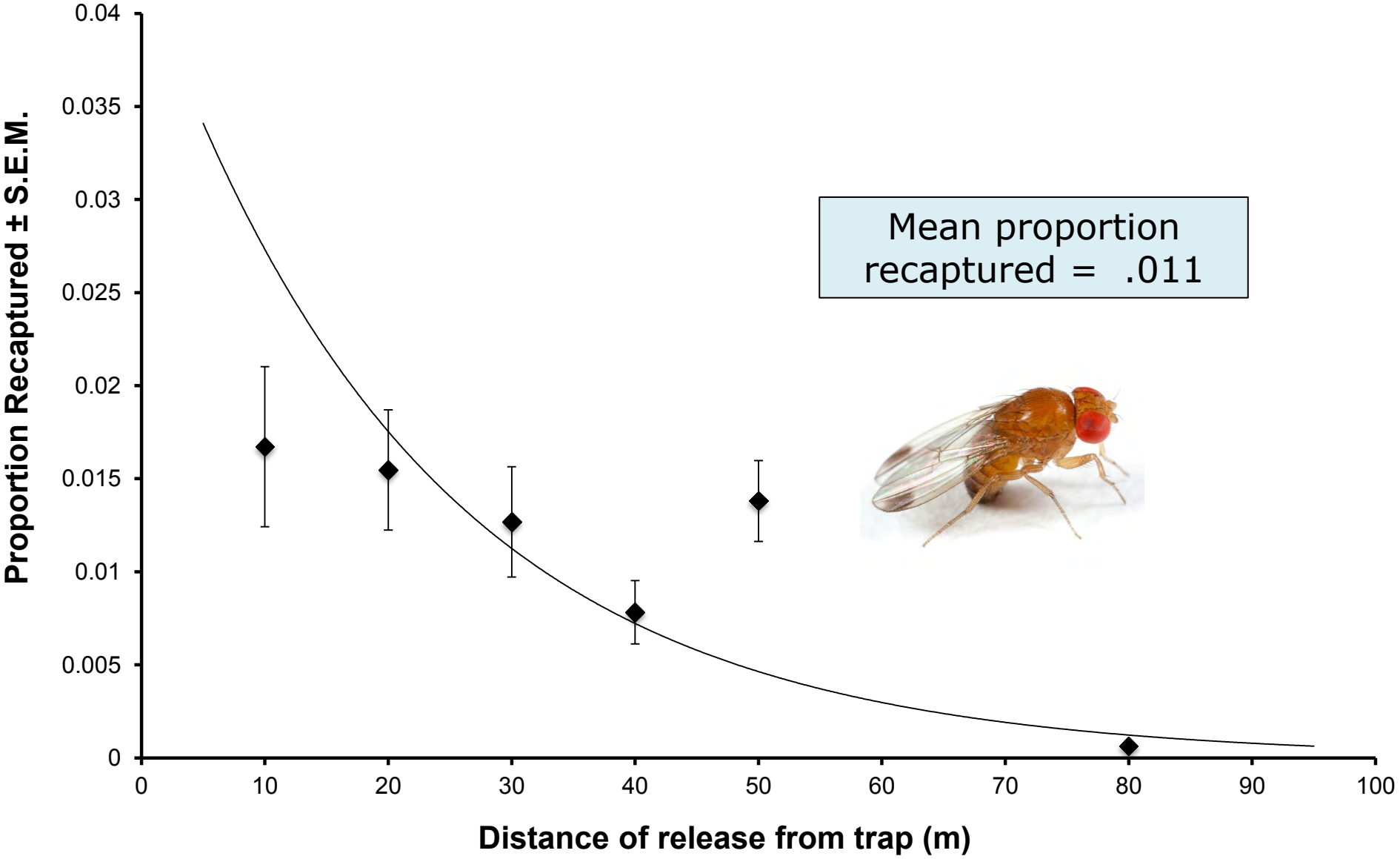
Methodology



Kirkpatrick et al. 2018

Single trap, multiple release method

Untransformed plot of trapping data



Transformed data: MAG Plot

Use slope of line to estimate plume reach of trap

y = 0.8847x + 54.185

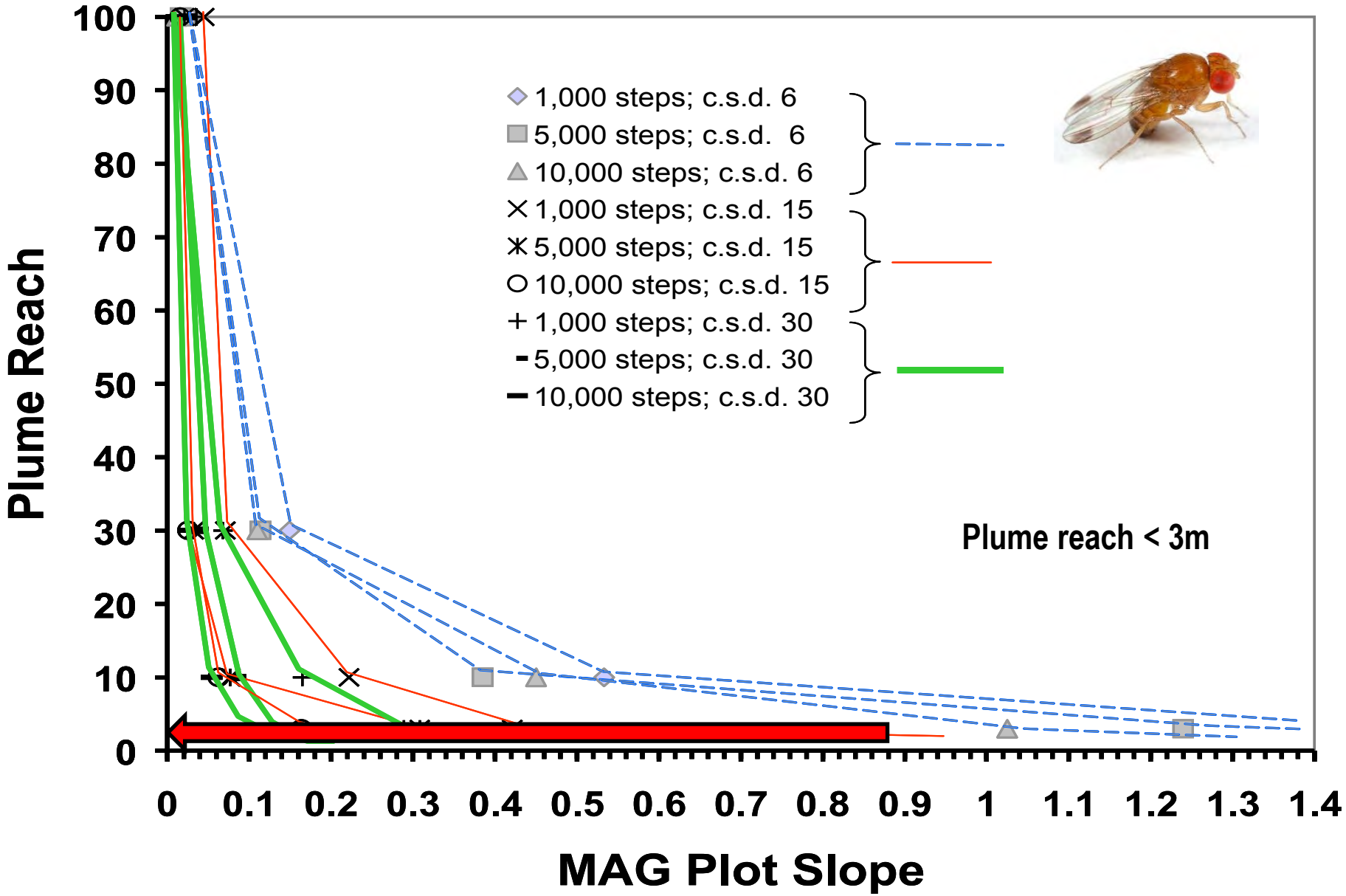
1/ Mean Proportion Recaptured

Distance of release from trap (m)

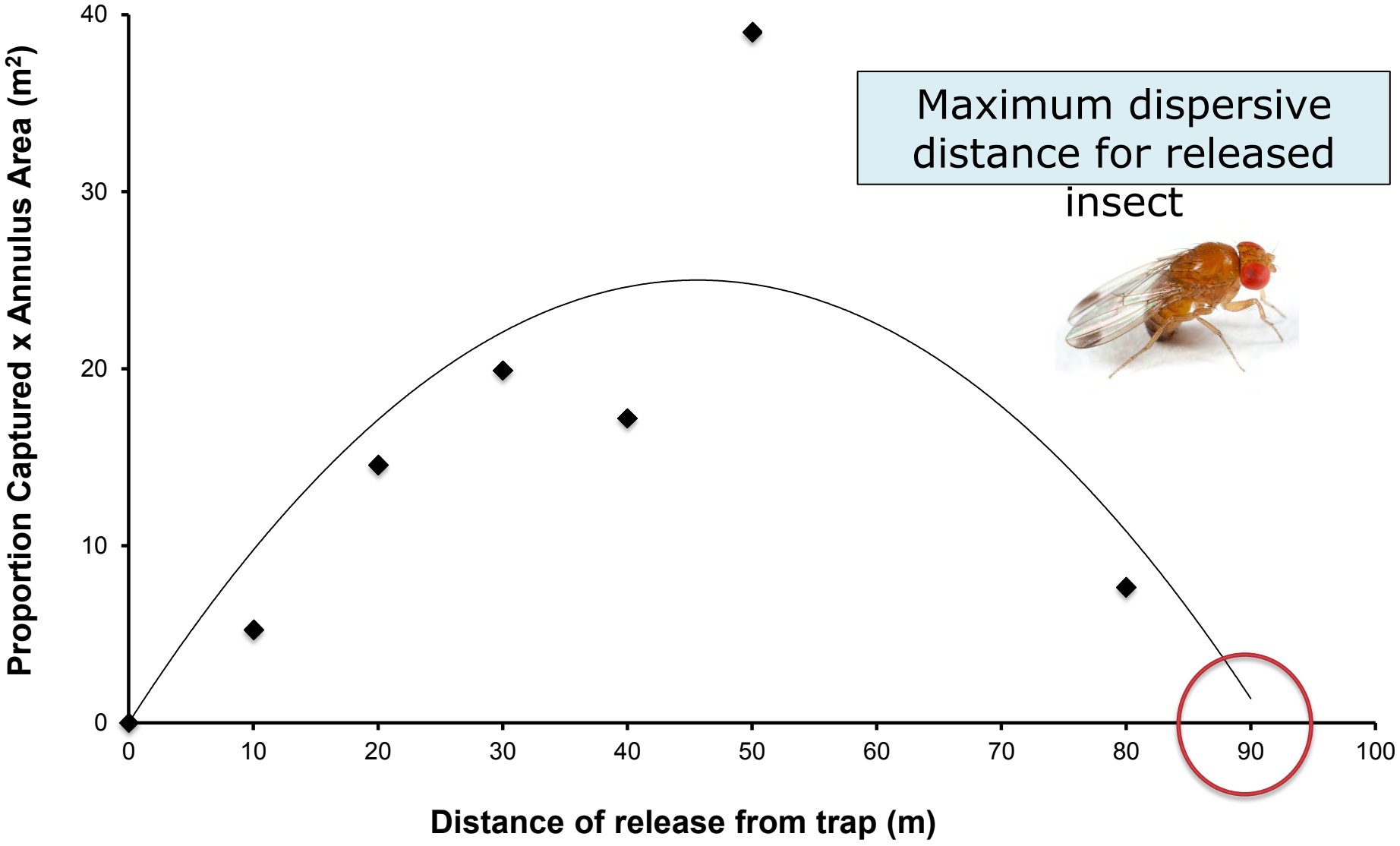
0 20 40 60 80 100 120 140

0 10 20 30 40 50 60

Lookup Chart to Estimate Plume Reach



Transformed data: Miller Plot



Trapping Area for SWD in Tart Cherry Orchard

- Recaptured < 2.0%.
- Plume Reach = < 3m.
- Maximum Dispersive Distance = 90 m.
- Trapping Area = 2.7 ha

Methods

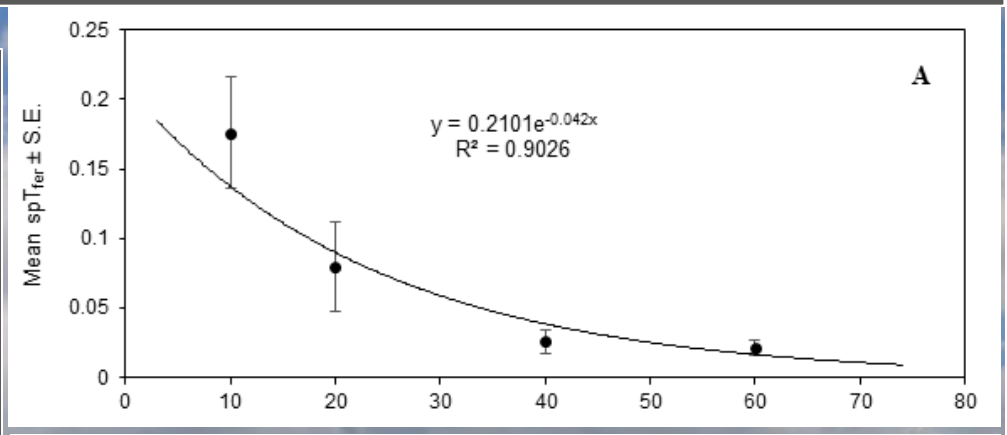
Unbaited Pyramid Traps 2m Away at Border of Area of Arrestment/Aggregation

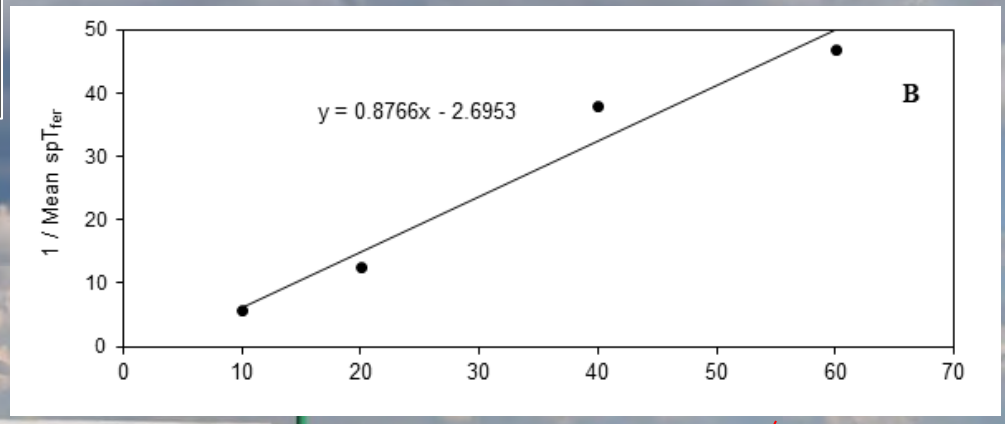
Morrison et al. 2016

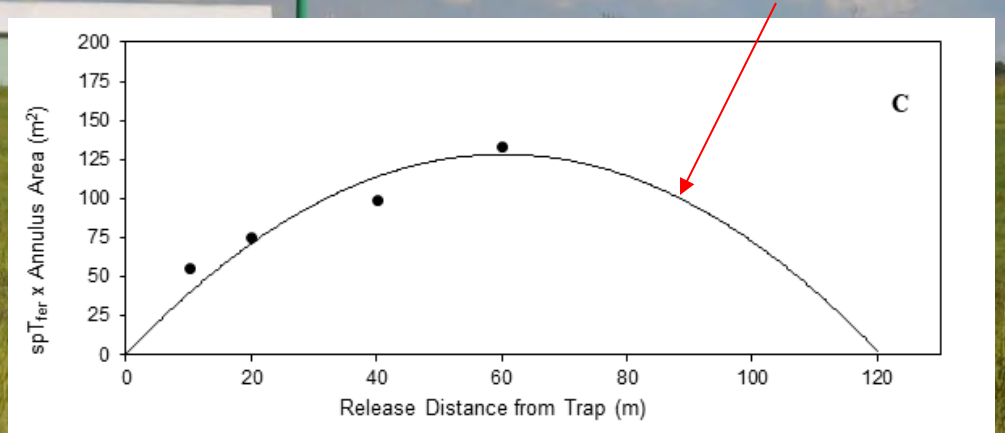
Preliminary Adult Study Results

Adults Mark-Recapture Open Field

- Recaptured 3.2% of marked adults.
- Plume Reach = < 3m.
- Maximum Dispersive Distance = 120 m.
- Trapping Area = 4.83.



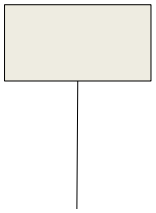




2018 Set-up in Open Field

Trapping Area Experiments

1



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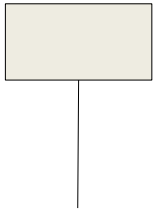

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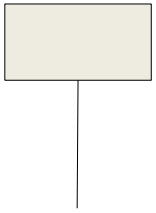
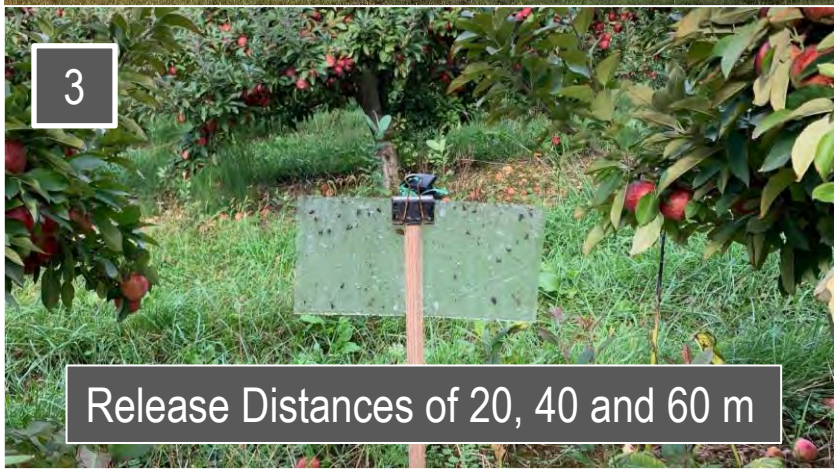
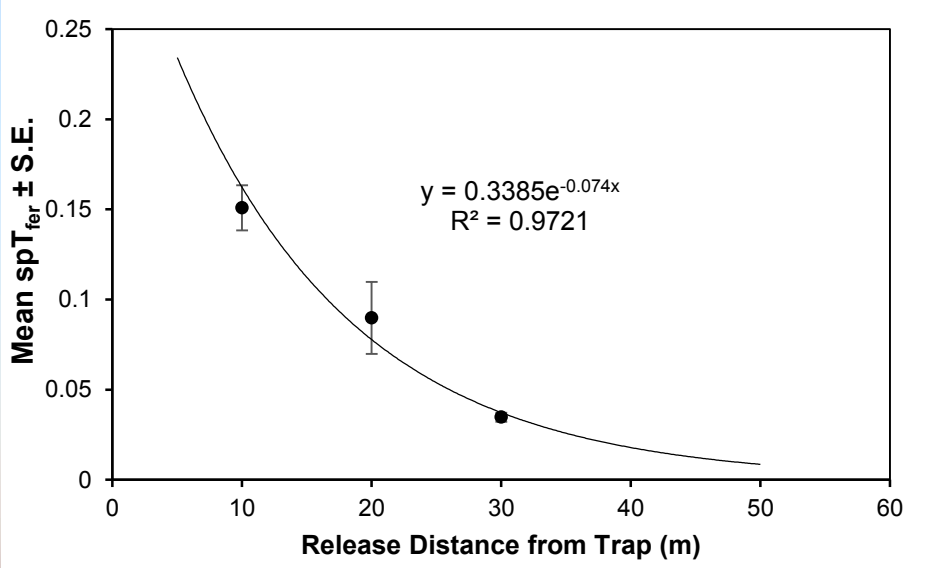
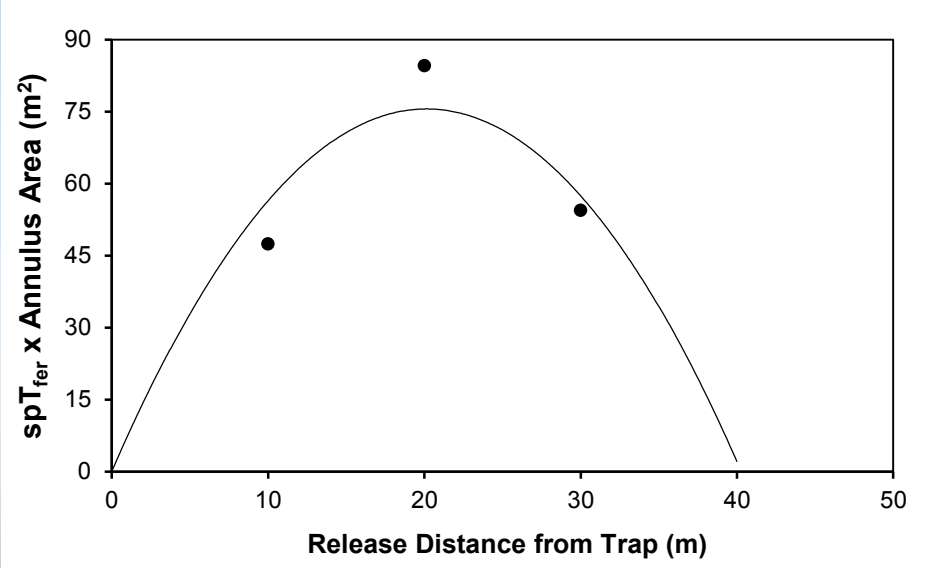
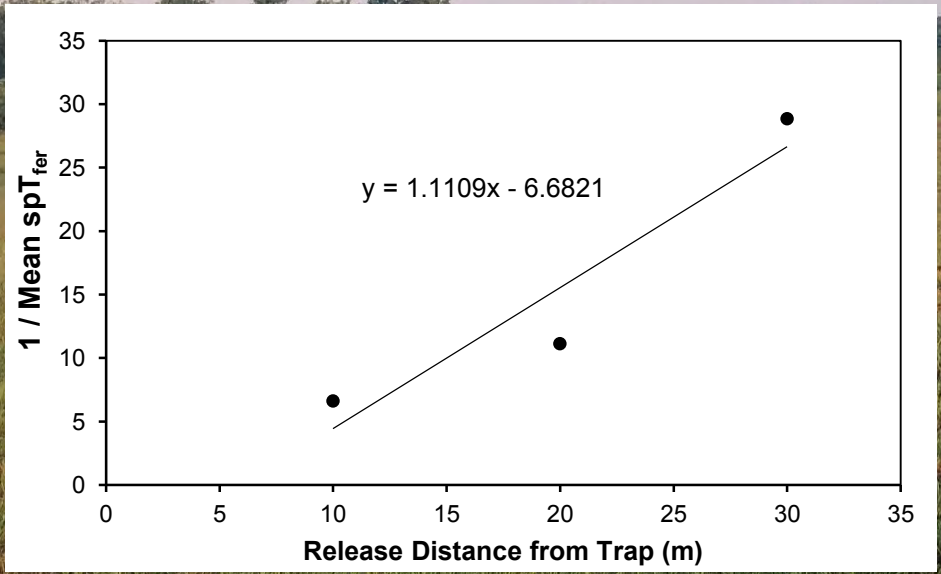




Nymphal Trapping Area Results





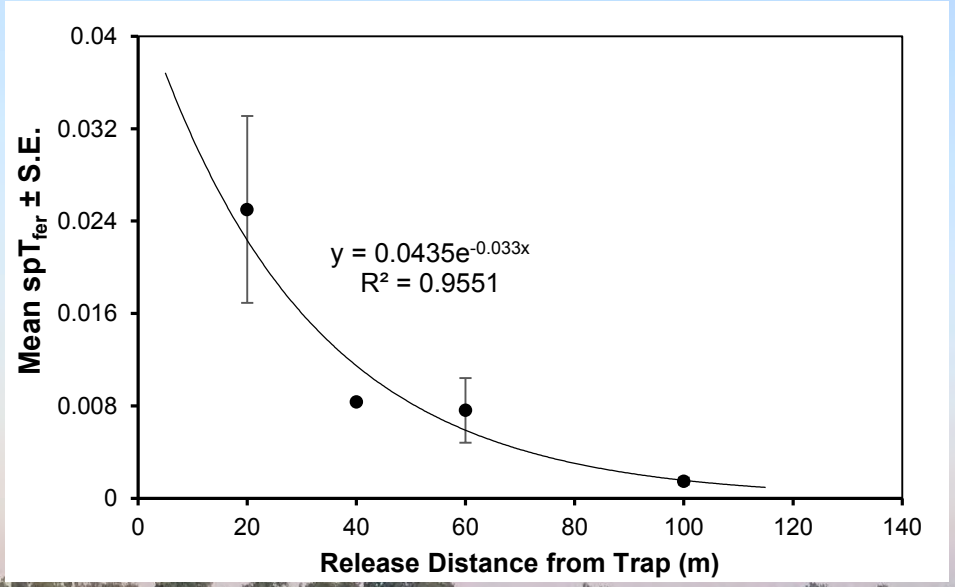


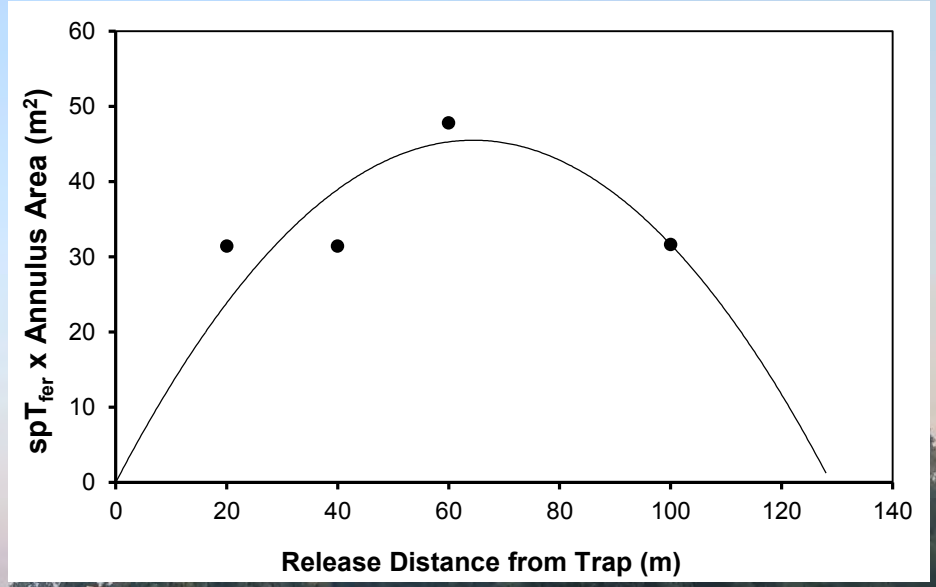
Nymphal Mark-Recapture Results

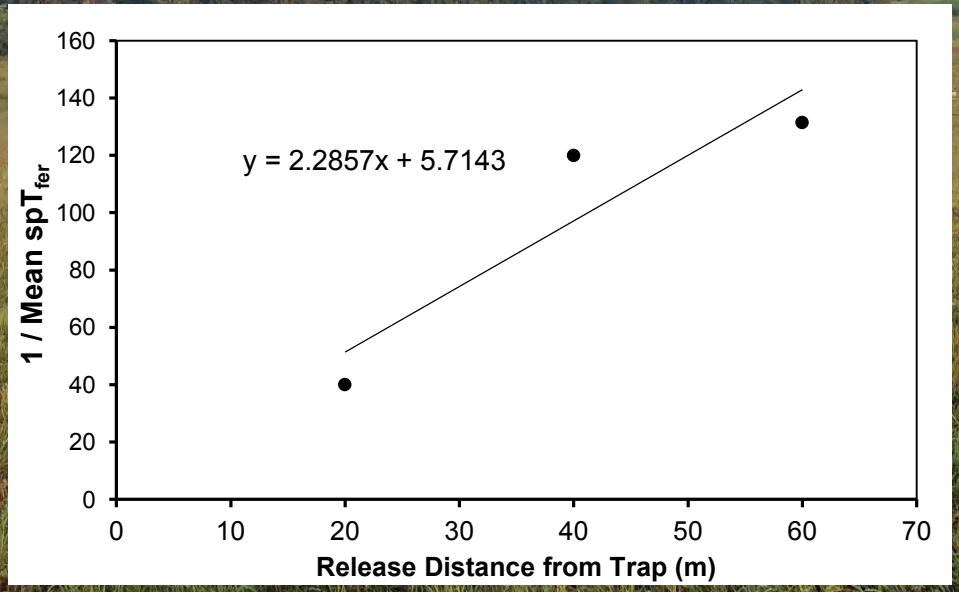
- Recapture 6.6% of released nymphs
- Maximum Dispersive Distance ~40 m
- Plume Reach < 3 m
- Trapping Radius = 43 m

- Trapping Area = 0.64 ha

Adult Open Field Trapping Area Results



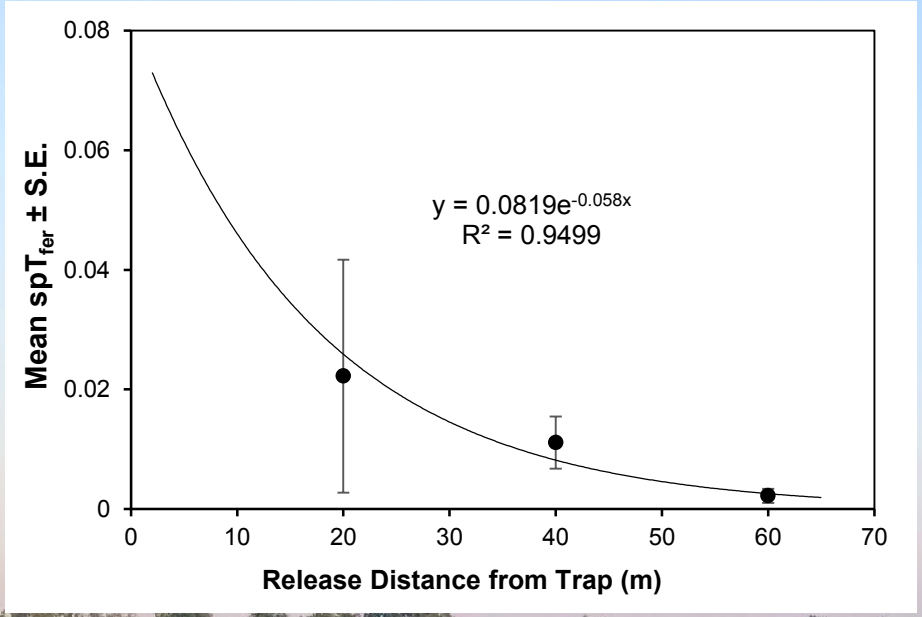


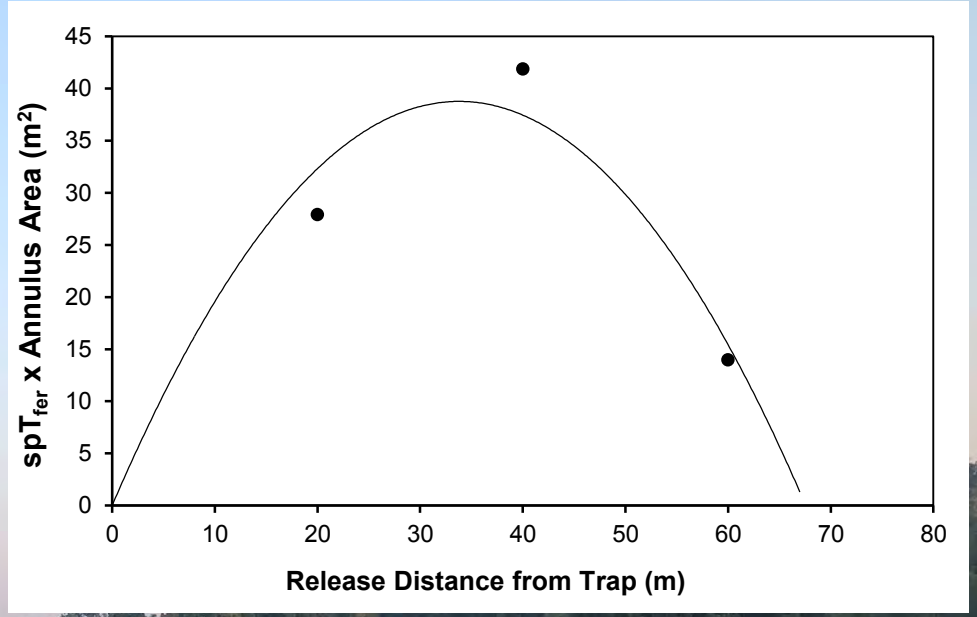


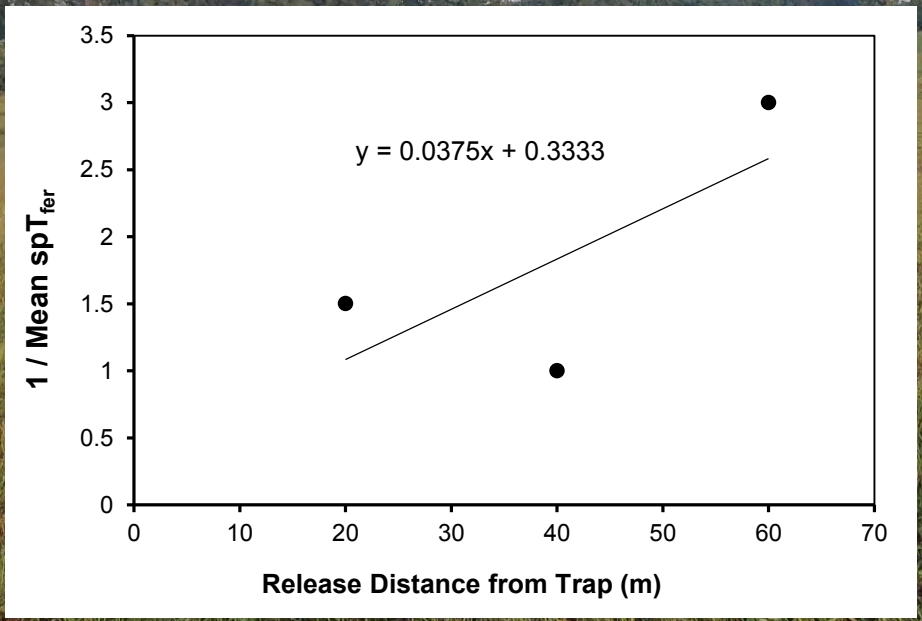
Adults Mark-Recapture Open Field

- Recapture 0.6% of released BMSB
- Max Dispersive Distance ~130 m
- Plume Reach < 3 m
- Trapping Radius = 133 m
- Trapping Area = 5.56 ha

Preliminary Adult Apple Block Trapping Area Results



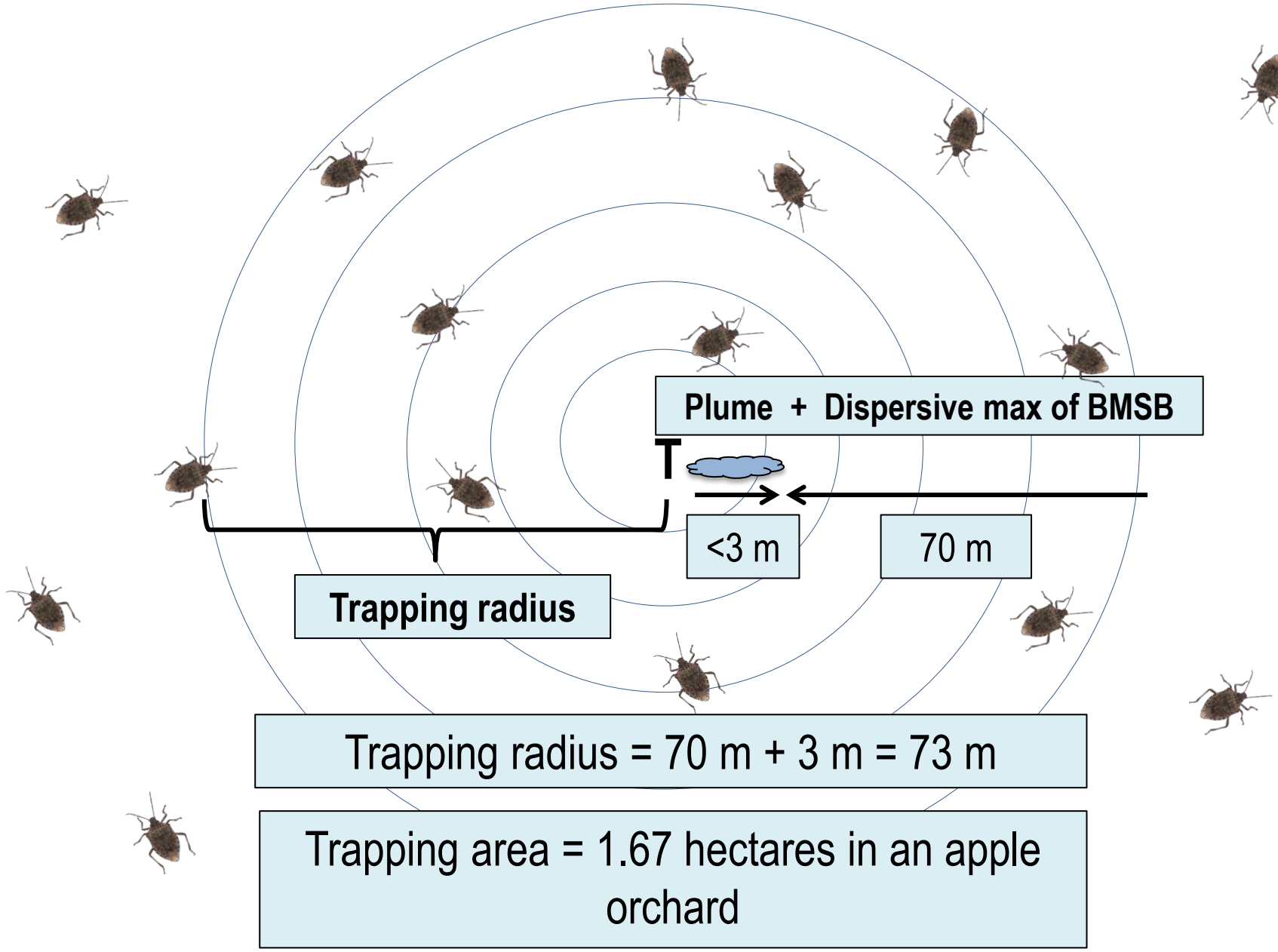




Adults Mark-Recapture Apple Block Edge

- Recapture 1.1% of released BMSB
- Maximum Dispersive Distance ~70 m
- Plume Reach < 3m
- Trapping Radius = 73 m

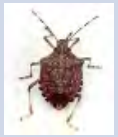
- Trapping Area = 1.67 ha



Trapping radius = 70 m + 3 m = 73 m

Trapping area = 1.67 hectares in an apple orchard

Results For Sticky Panel Trap Baited with Trece Monitoring Lure

Life Stage	Experiment	Percent Recaptured	Plume Reach	Maximum Dispersal Distance	Trapping Area
Adults 	Open Field With Pyramid Traps	3.2%	< 3 m	120 m	4.83 ha
	Open Field	0.6%	< 3 m	130 m	5.56 ha
	Apple Orchard	1.1%	< 3 m	70 m	1.67 ha
Nymphs 	Open Field	6.6%	< 3 m	40 m	0.64 ha

•Estimated plume reach is short for both adults and nymphs evaluated here.

•Maximum dispersive distance was reduced in an orchard indicating that more traps would be necessary to reliably capture adults when apple (and probably other hosts plants) are present.

•Influence of other host plants?

Kirkpatrick et al. in prep.

Tentative Guidelines for Trapping BMSB in Apple Orchards

- Deploy traps within the border row and at center (especially if border-based management tactics are being used) of plot. BMSB damage will likely be present on nearest neighbor trees.
- Border traps should be deployed along riskiest borders, i.e., wood lots or other specialty and row crops that generate BMSB. Use captures on these traps to guide management decisions.
- Based on trapping radius, traps can be spaced ~40m apart and not compete with each other. One trap should sample from an area of 1.67 ha. We recommend three traps on a risky border spaced ~50 m apart.
- Based on results to date, a cumulative threshold of 4 adults/trap triggers sprays at appropriate intervals. Verifying in 2019.

Greetings from West Virginia