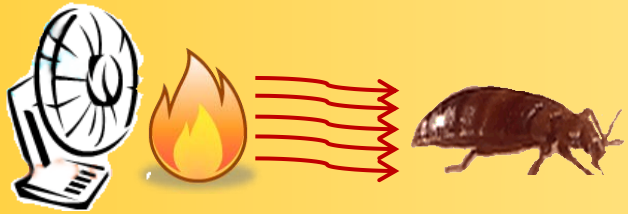




Improvements in Prevention and Control Techniques

Using Heat for Best Effect

Dr. Stephen A. Kells

Presented at the
Second National Bed Bug Summit
February 1, 2011

Presentation Outline

1. Temperature Extremes and Insects
2. Use of Dry Heat
3. Use of Steam

Temperature Extremes and Insects

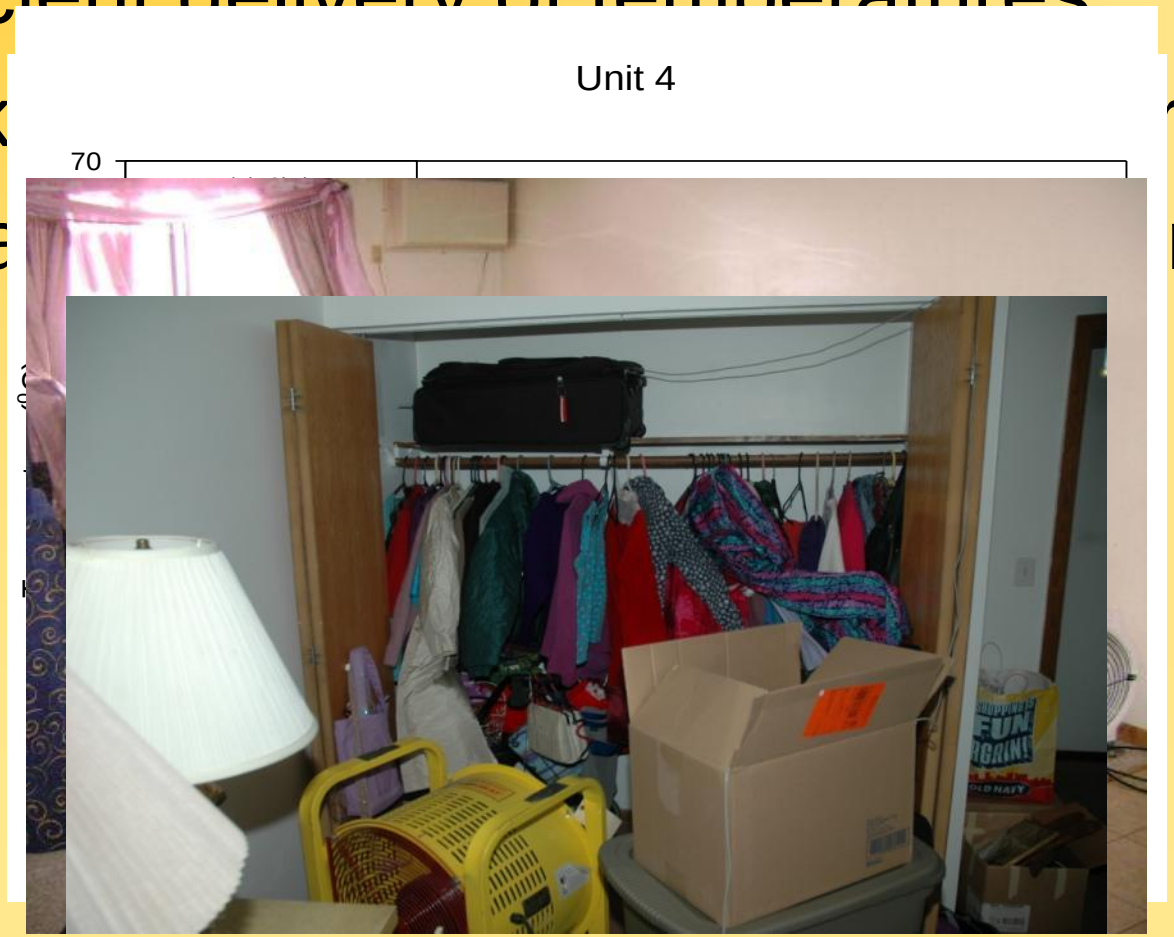
Above 120 ºF

Death in minutes

Cell walls and genetic materials melt
Proteins denature (cooked eggs)
Desiccation from water loss

Challenges

- Obtaining acceptable temperatures
- Efficient delivery of temperatures
- Mak rs
- Wha nt?



Dry Heat: Chamber Treatments

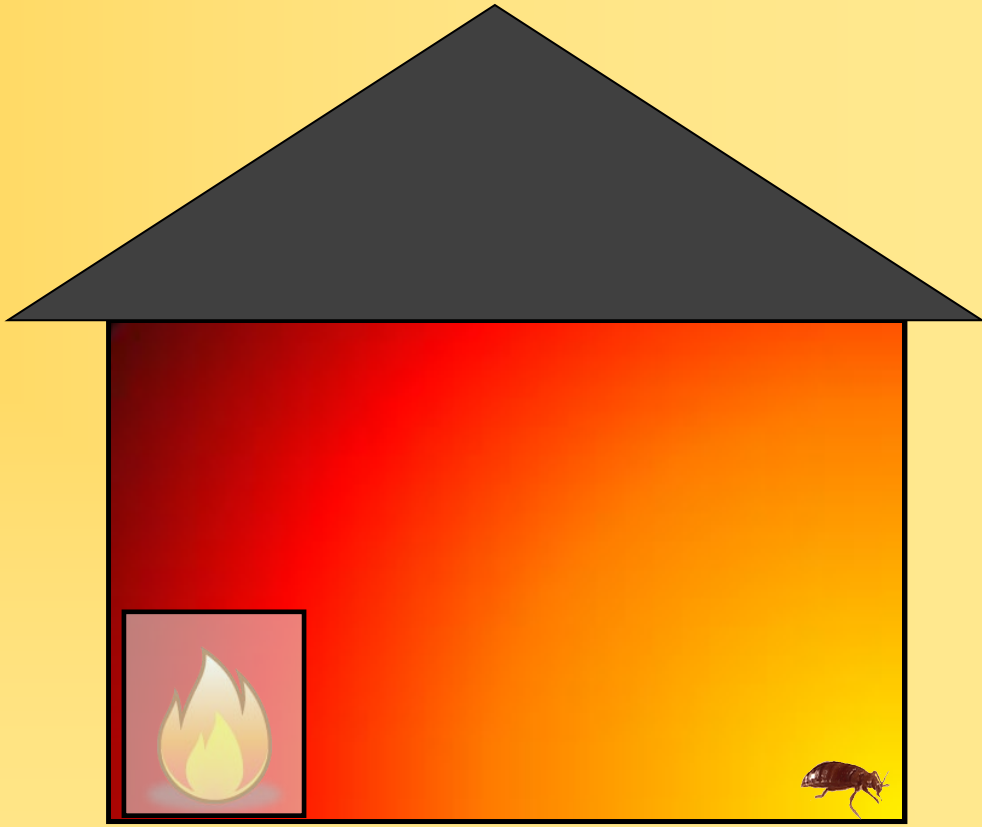
Bruesch, Plunkett's

Pereira and Koehler, UF

Whole Room Heat Treatments

Critical Temperature?
Behavioral Responses?

113 ºF



? ºF

Critical Temperatures

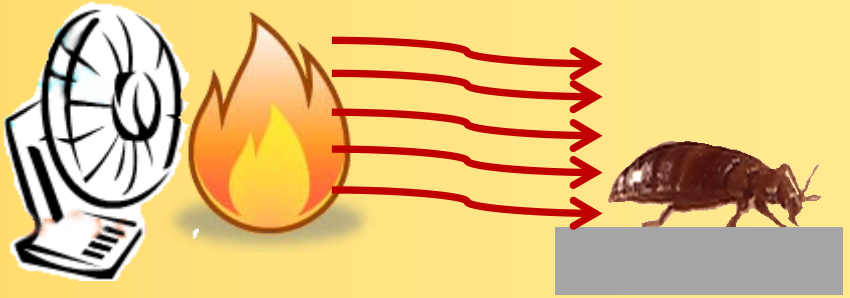
- Immediately lethal: **Adults 118 ºF**
  Eggs 122 ºF
- Below IL temperatures,
  time becomes important

Temperature	Adults	Eggs
113 ºF	90 mins	7 hours!
118 ºF	20 mins	90 mins

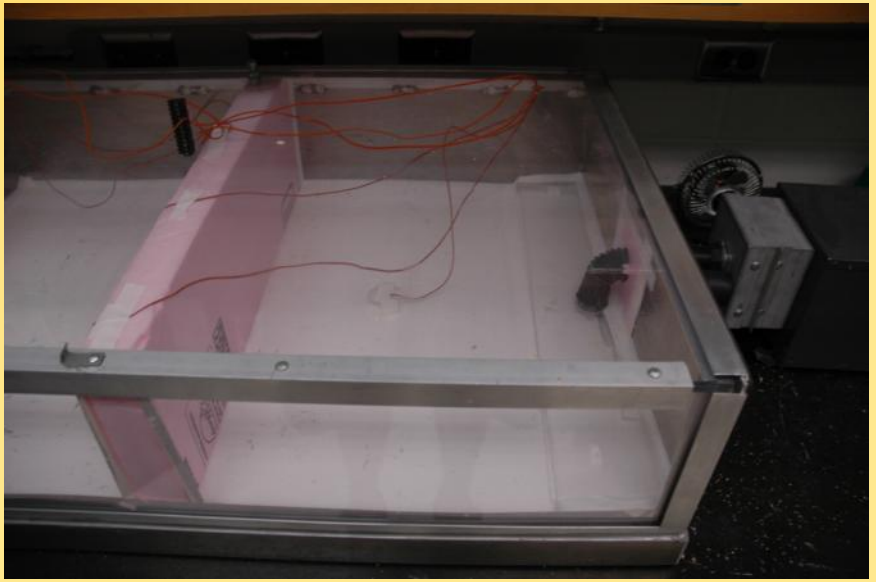

“Delivery” temperatures approx.130 – 145 ºF

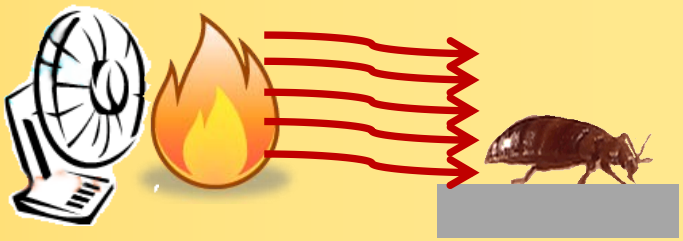
Behavioral Response to Bed Bugs

Conduction



Convection





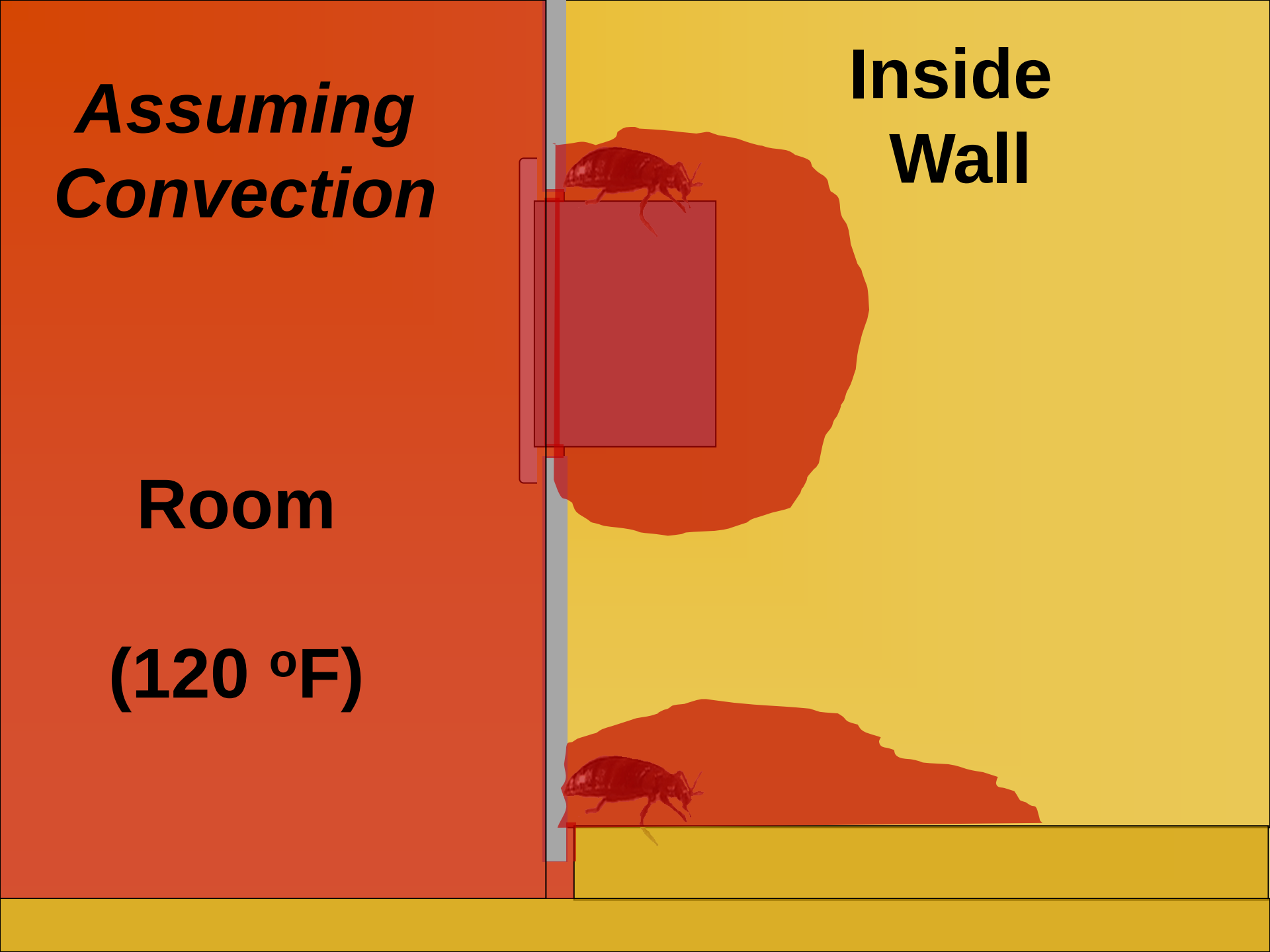
Conduction		Convection
80 ºF	Movement Threshold	n/d
95 ºF	Feeding Threshold	n/d
105 ºF	Escape Temperature	118 ºF

Assuming Conduction ONLY

Room

(120 ºF)

Inside Wall


Assuming Convection
Room
(120 ºF)
Inside Wall

Add Insecticides

Room

Inside Wall

Steam Treatments

- A problem of bed bug resistance!

  Effective in eliminating call backs
- But what are its limitations?
- Other considerations?

Reaching Target Temperatures

160 – 180 ºF immediately after steam unit has treated area.

Steamers and penetration of heat

Steam penetration depends on

Fabric, fill density, Stitch holes

Reasonable penetration is up to

¾” for fabric

2-⅜” for gaps

Towels over nozzle reduces penetration

Nozzle Shapes

No difference in penetration

Triangle

2”

Difference with nozzle velocity and area covered!!!

Floor Brush

Steam Generators

The Work Continues…..

- Improving critical temperature estimates
- Insecticide efficacy, substrates and heat
- Low critical temperatures for effective control

Thank you!

www.bedbugs.umn.edu

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