

Urban entomology; bed bugs

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In this talk,

- **Introduction**

: Problems related with bed bugs.

- **Understand bed bugs**

#1 Biology and behavior

#2 Common bed bugs *vs* Tropical bed bugs

#3 Management

- **Conclusion**

: We need to be prepared.

Problems related with bed bugs

Introduction

Introduction

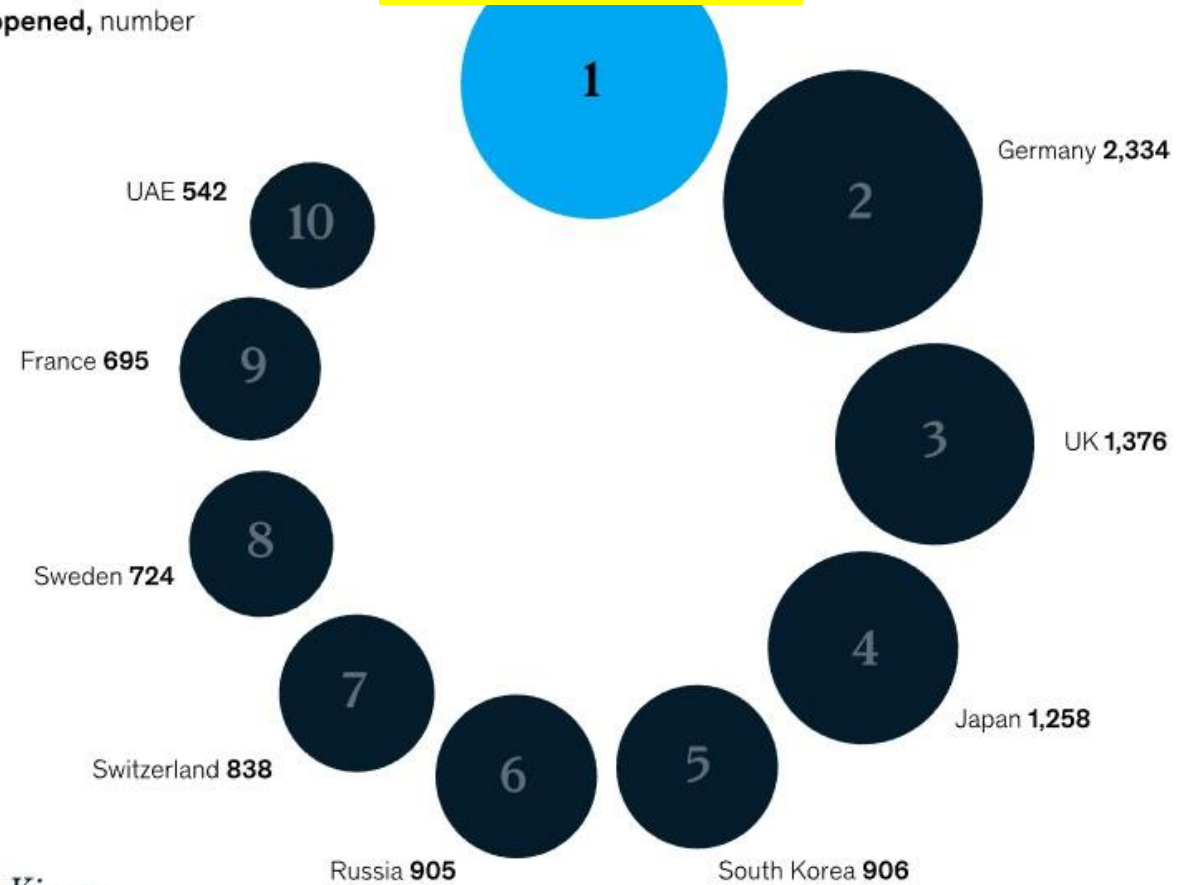
“American ranked top visitors to Thailand (after reopening)”



Thailand's phased reopening has attracted tourists globally.

Top 10 countries by visitors to Thailand after borders reopened, number

#1 US 2,465



McKinsey
& Company

Schools in the US are **shutting down again**



"Bed bugs in classroom"

(16 Feb. 2023, Philadelphia)

Officials with School District of Philadelphia takes action to prevent bed bug infestation

response to a **bed bug** being found in your child's **classroom**.

This letter has been sent to you in response to a bed bug being found in your child's classroom. Although it is often very difficult to identify the source of the bed bug and pinpoint how it was brought into the school, our staff is in the process of conducting a thorough inspection of the school and treating appropriately where necessary. We will continue to monitor the situation and consult with Student Health to eliminate any bed bugs in the building and to minimize the potential for future bed bug activity in the school.

Although bed bugs are a nuisance, they have not been known to spread disease. Anyone who comes in direct contact with bed bugs or their eggs can unknowingly carry them into their home or workplace. They are easily spread by moving beds, furniture, luggage, or clothing from one location to another. For this reason, it is important that you inspect your child's backpack, lunch bag and other items regularly for the presence of bedbugs.

If you have any questions regarding bed bugs or our response efforts, please feel free to contact the Principal or School Nurse.

Sincerely,

Ms. Dana Singletary

FOX29

10:34 PM 54° GEORGIA GRAND JURY REPORT ON TRUMP ELECTION PROBE PARTIALLY RELEASED: | NATION



Bed bug biting...





EXCLUSIVE

News > UK News

JUST PLANE AWFUL Furious mum slams British Airways after daughter, 7, was ravaged by BED BUGS and left bleeding on flight

Heather Szilagyi, from Vancouver, told The Sun how she saw the critters crawling out from behind her in-flight TV frames and food tray during the journey

Corey Charlton

Published: 11:46, 15 Oct 2017 | Updated: 13:53, 16 Oct 2017



News > UK News

HOLIDAY HELL Furious gran demands £12k TUI holiday refund after grandson, 4, 'eaten alive by bed bugs' at luxury four-star Catalonia hotel

Jessica Cripps and Joe Duggan

Published: 11:34, 29 Aug 2019 | Updated: 11:35, 29 Aug 2019

Jalan Besar hotel guests covered in bed bug bites after 2-night stay, hotel says **guests likely brought bugs in**

Upon an inspection of the rooms the guests stayed in, the hotel said their pest control vendor only found "a couple of" adult bed bugs and no eggs.

Ashley Tan | June 28, 2022, 06:43 PM



"Bed bugs are expected problem"





Family of man 'eaten alive by bed bugs' in Fulton County Jail calls for changes

[Visit](#)

Uploaded: Apr 12, 2023

502K Views · 4.22K Likes

Family attorneys say Thompson was in jail for three months when he was found dead in a jail cell after being eaten alive by bed bugs and insects. Full story:...



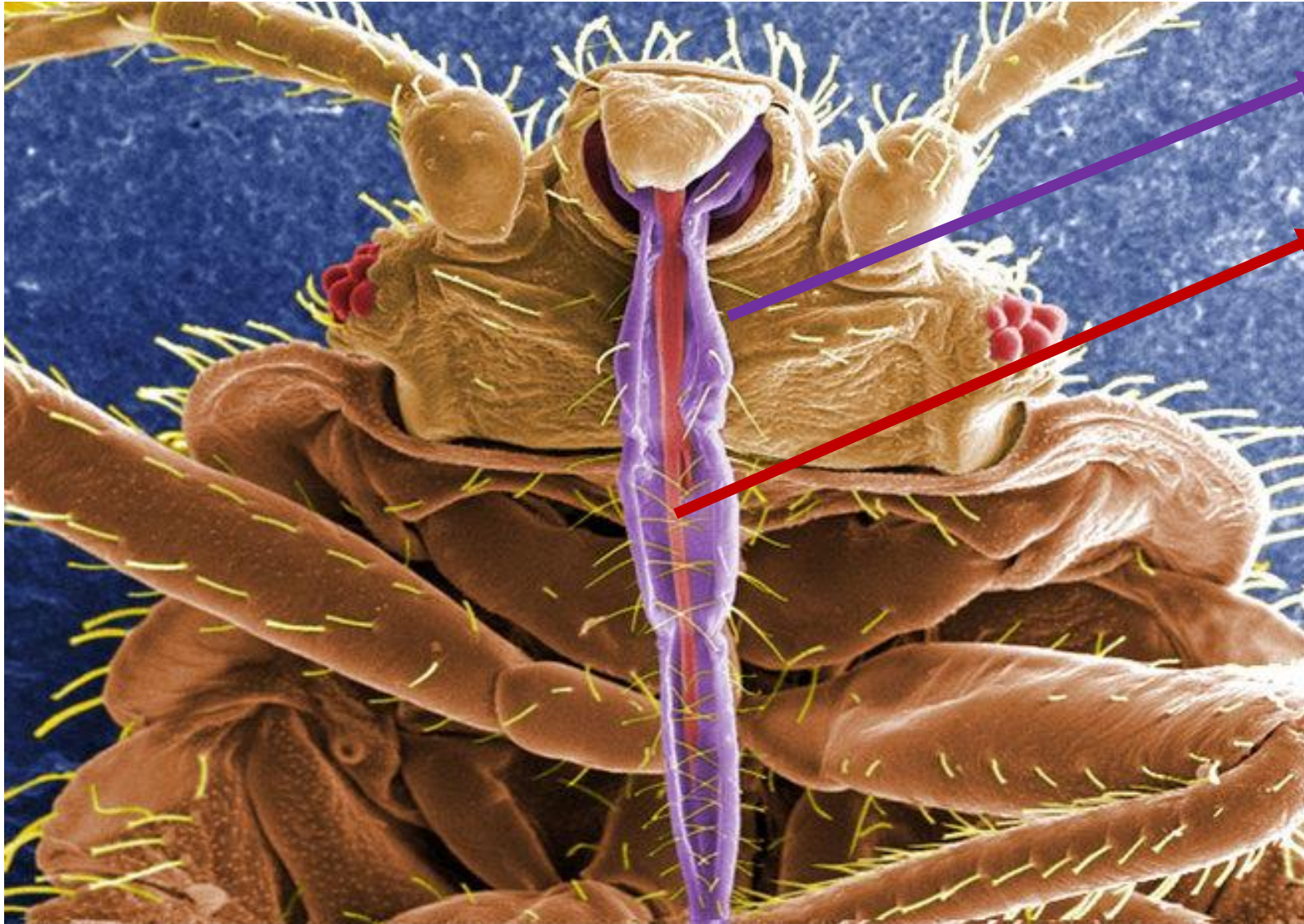
YouTube

Atlanta News First · 2:54

Understand bed bugs

1. Biology and behavior
2. Common bed bugs vs Tropical bed bugs
3. Management

Piercing-sucking mouthparts



Proboscis

Stylet

"Hematophagous"



Aggregation

They are attracted by **aggregation pheromones** from **feces** and **exuviae**.

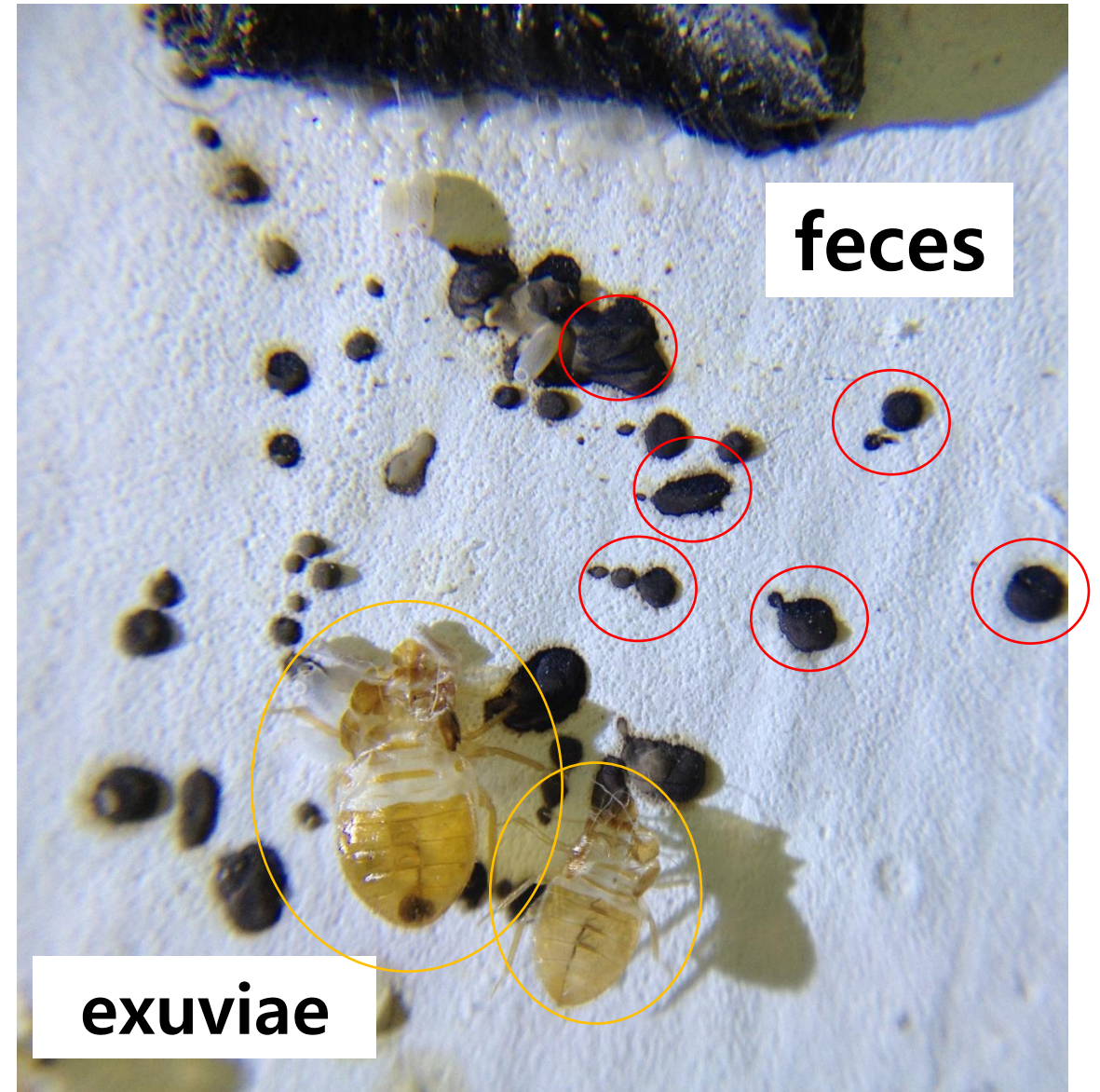
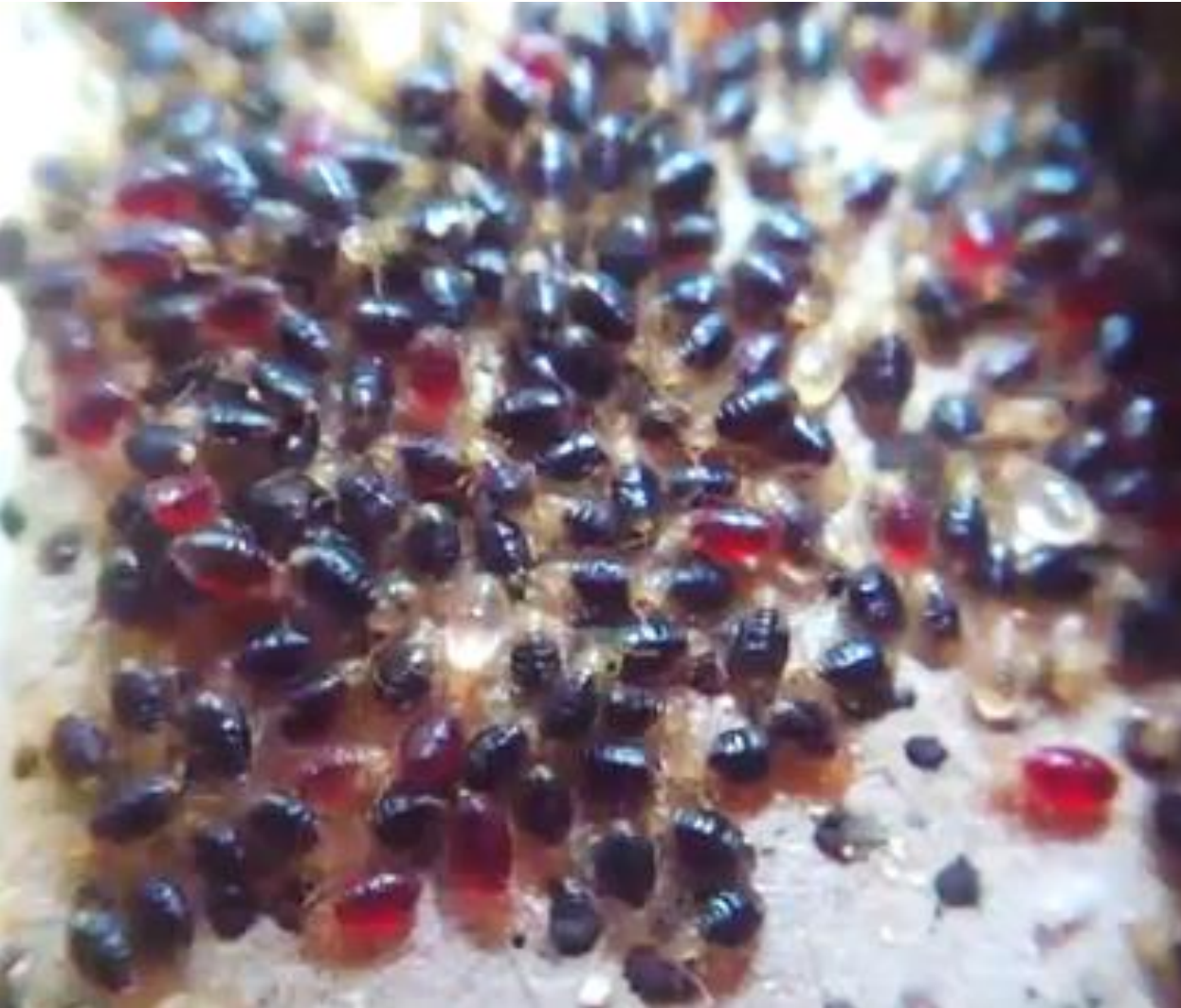


Photo by Daeyun Kim

Aggregation (cont.)





Harborage



Harborage



"90% are nymphs"



Lined bite pattern
; Number of bed bugs feed in a line.



Minocah et al. (2016)

Allergic reaction
; Developed an erythrodermic reaction.



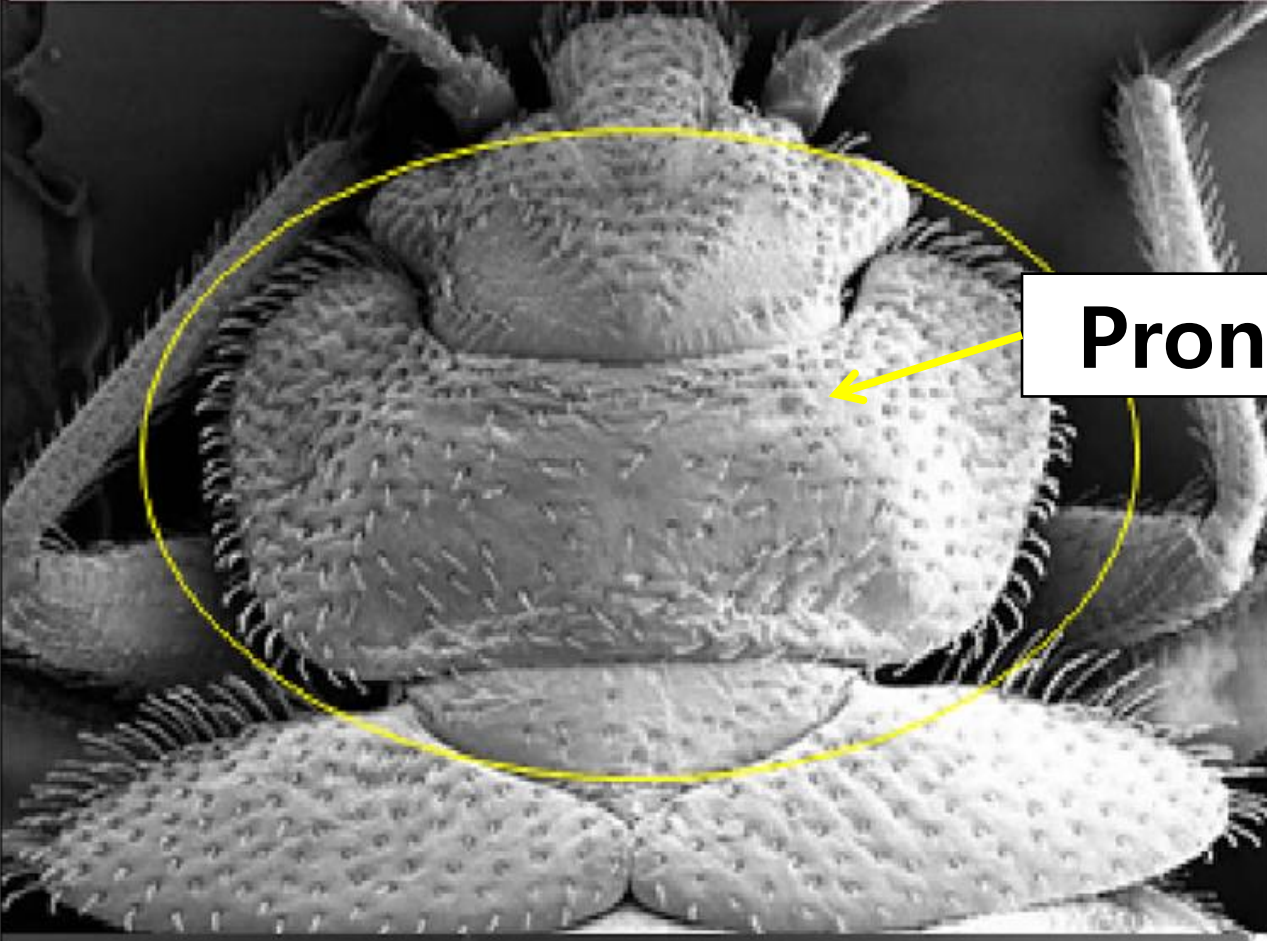
Secondary infection

; Through compromised skin wounds.

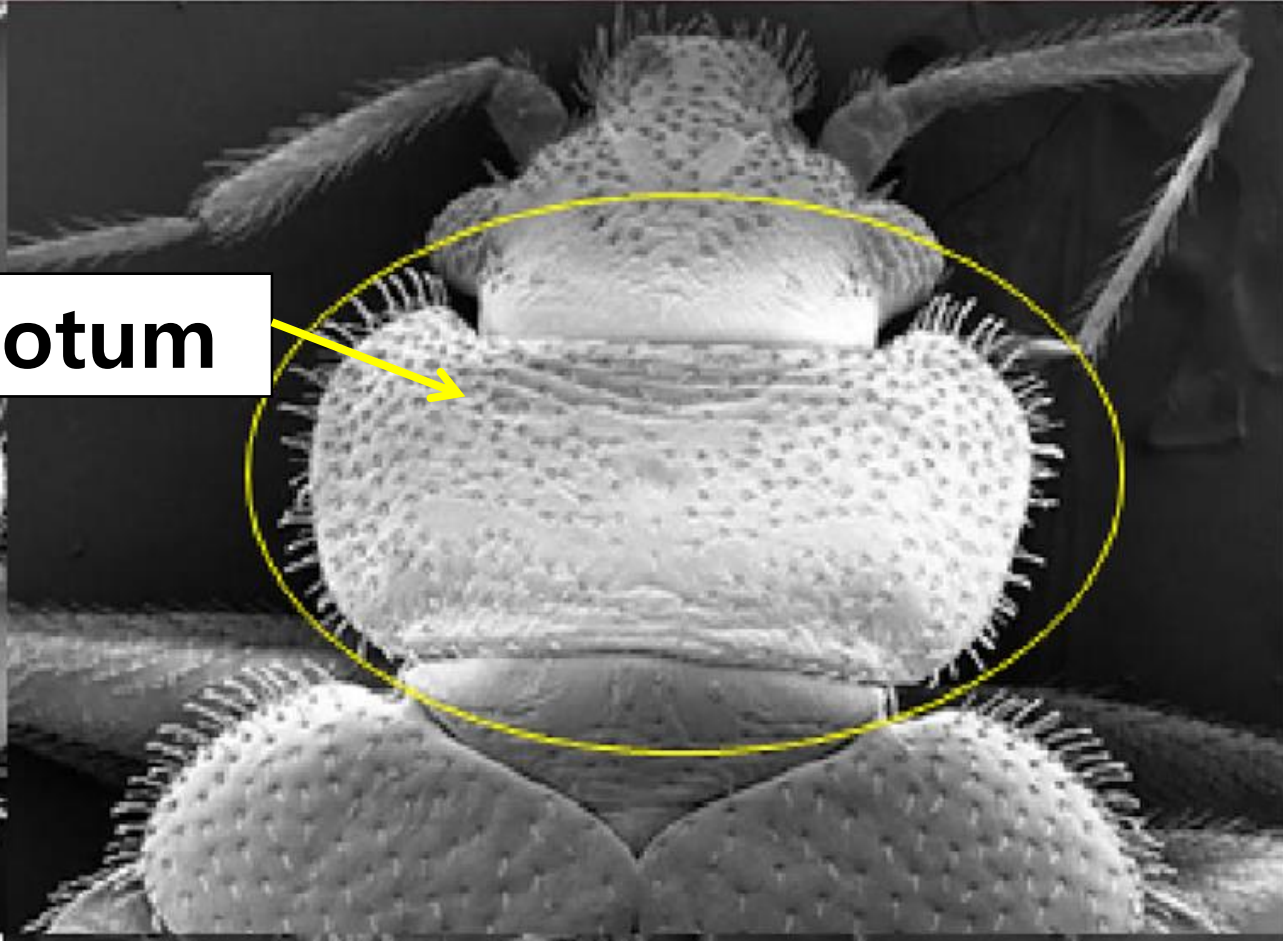
e.g. *Trypanosoma cruzi* (Chagas disease)

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Pronotum



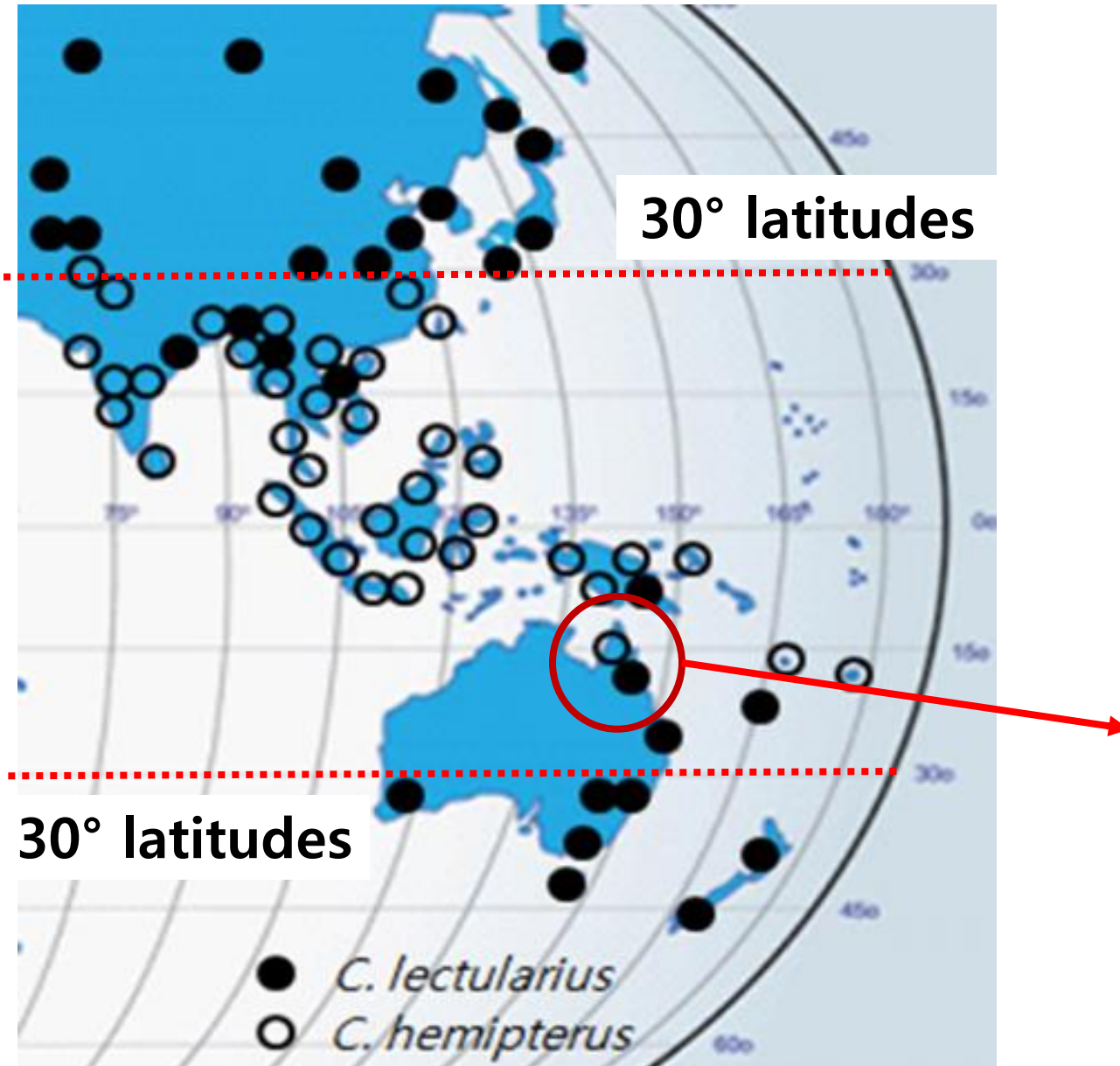
"Wider, wing-like"

**Common bed bug
*Cimex lectularius***

"Slender, narrower"

**Tropical bed bug
*Cimex hemipterus***

Geographical distribution



*"Common bed bugs are predominant in climate region while tropical bed bugs are mainly in **SEAsia**"*

(Omori 1946)

"Both species are mixed in some locations."

(Doggett et al. 2003)

NEWS RELEASE 15-MAR-2017

Some bed bugs are better climbers than others

Bed bug species *Cimex hemipterus* climbs out of smooth-walled traps with ease

Peer-Reviewed Publication

ENTOMOLOGICAL SOCIETY OF AMERICA

(Kim et al. 2017)

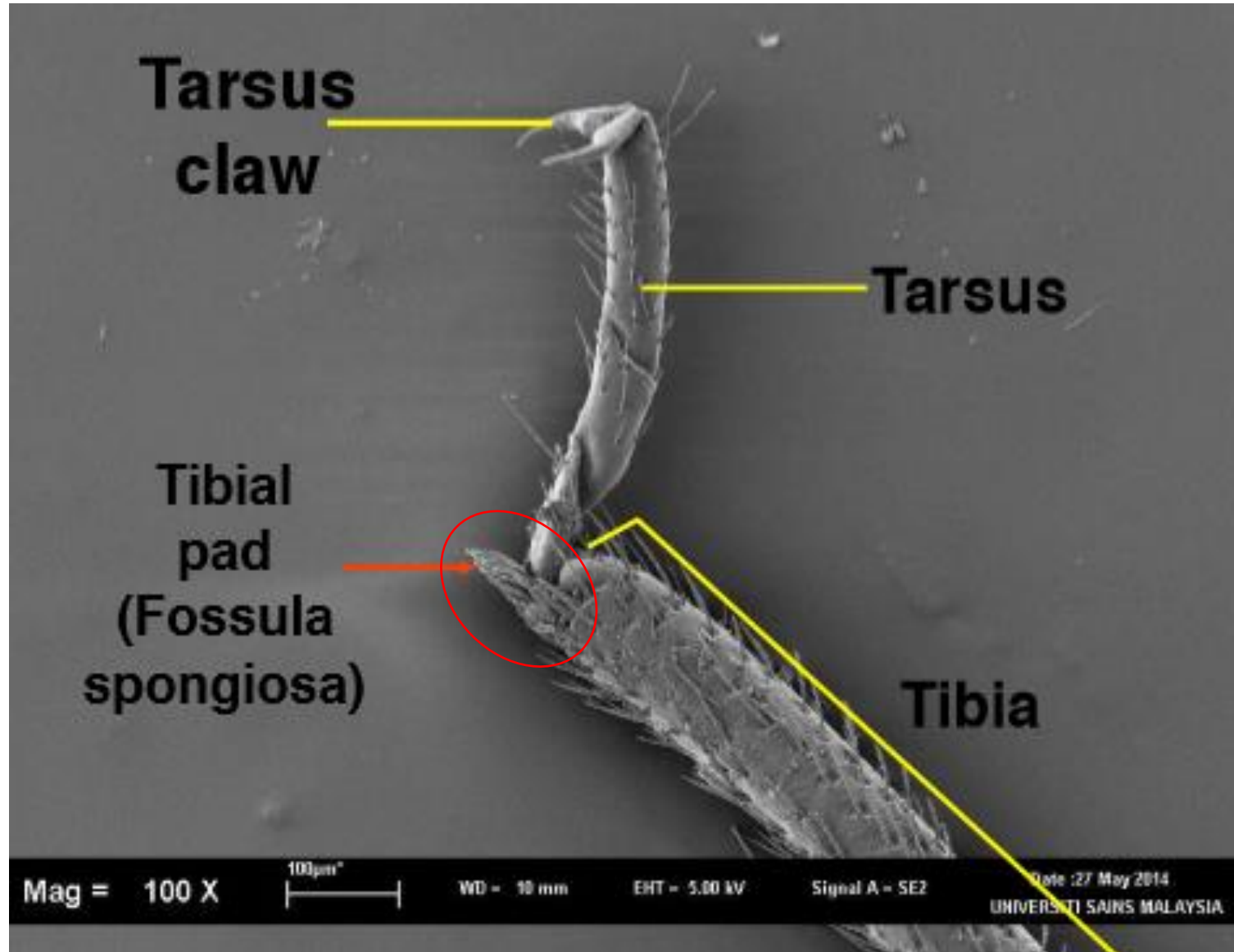


All Stages Of Bed Bugs Were
Captured In The Verifi™ Detector Pitfall.

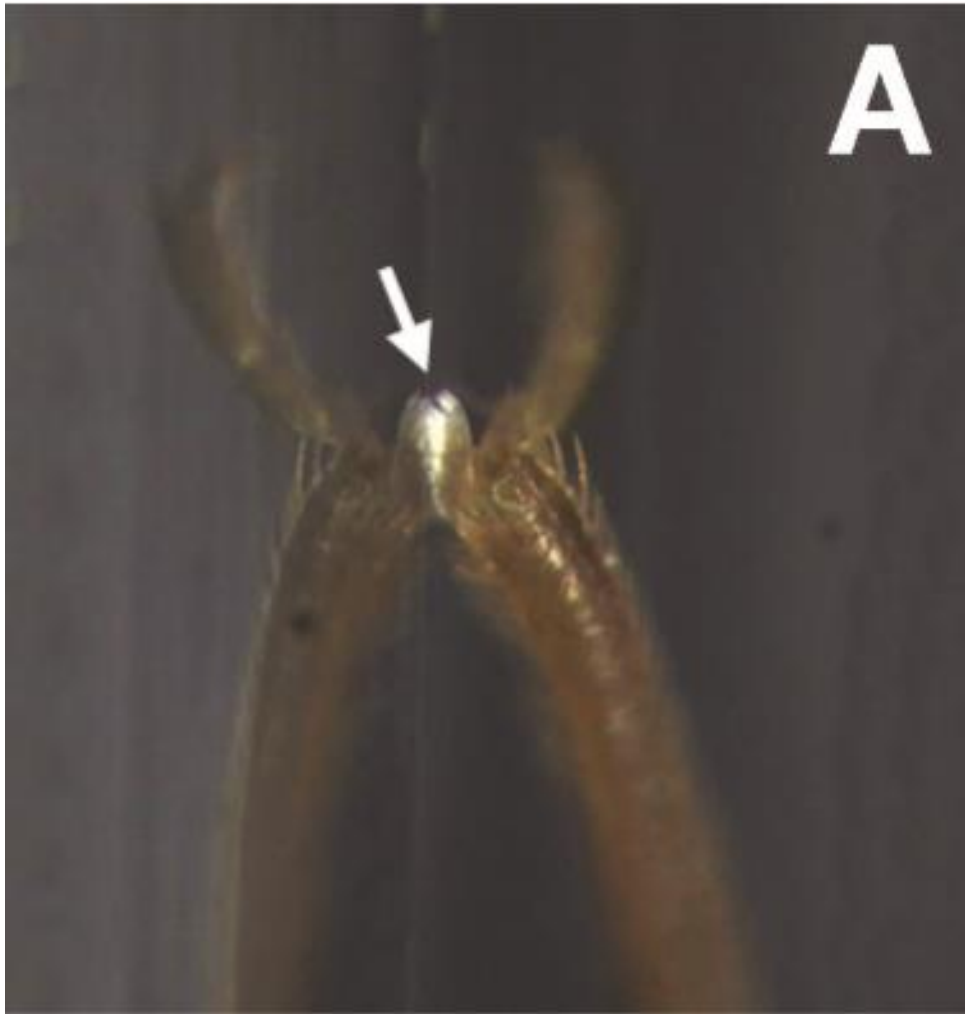




Bed bug's leg structure



Bed bug's leg structure (cont.)



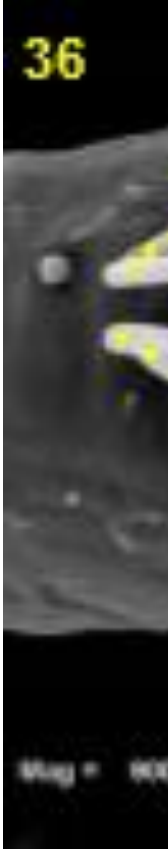
Smooth surface (plastic)



Rough surface (paper)

Kim et al. (2017)

Bed I



2017)



Understand bed bugs

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Seriously infested cases...



Credit: Daeyun Kim

Inspection



Credit: Daeyun Kim

Sniff dogs?



“Remote monitoring”

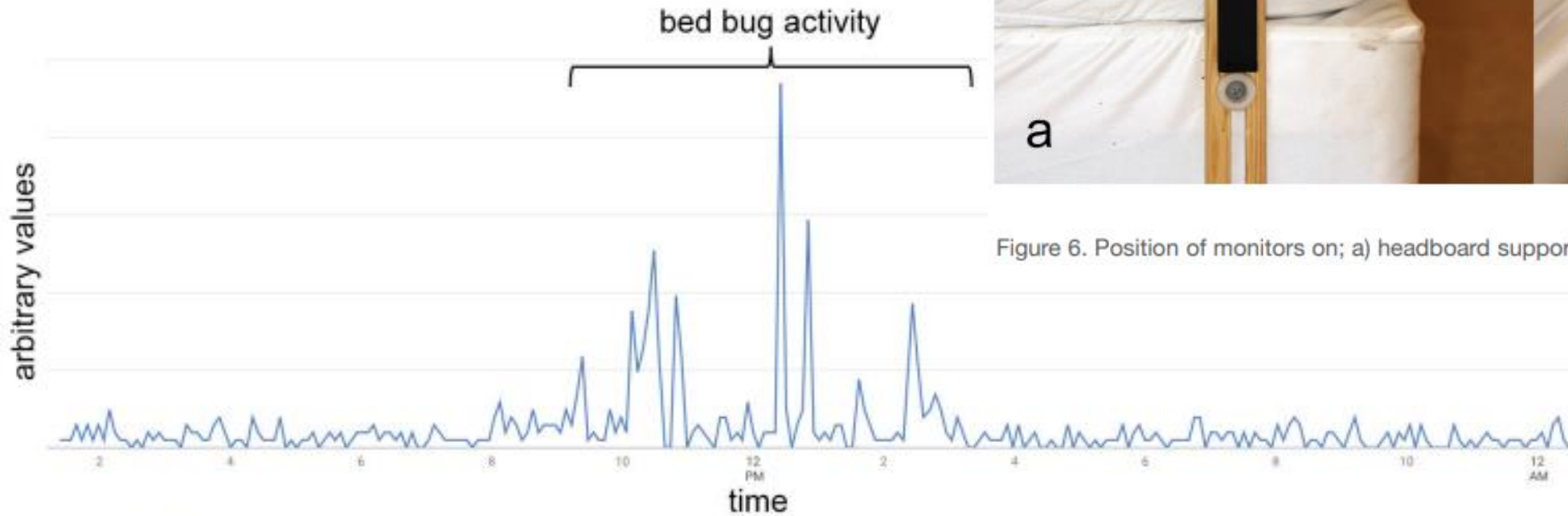


Figure 2. Variation in arbitrary capacitance values caused by activity of one bed bug within the monitoring device.



Figure 6. Position of monitors on; a) headboard support, and b) doorframe.

(Naylor et al. 2020)

Alternatives



Sleep tight! Bed bugs rely on chemical cues to locate and arrest in safe shelters. This **aggregation pheromone** comprises five volatile components (dimethyl disulfide and dimethyl trisulfide, (E)-2-hexenal, (E)-2-octenal, 2-hexanone) that attract bed bugs, and one less-volatile component (histamine) that causes their **arrestment** upon contact. This blend is highly effective at luring bed bugs into traps in infested premises.

(Gries et al. 2014)

Management



Vacuuming + spraying (or dusting)

Problems



“Pesticide resistance”



Credit: Daeyun Kim

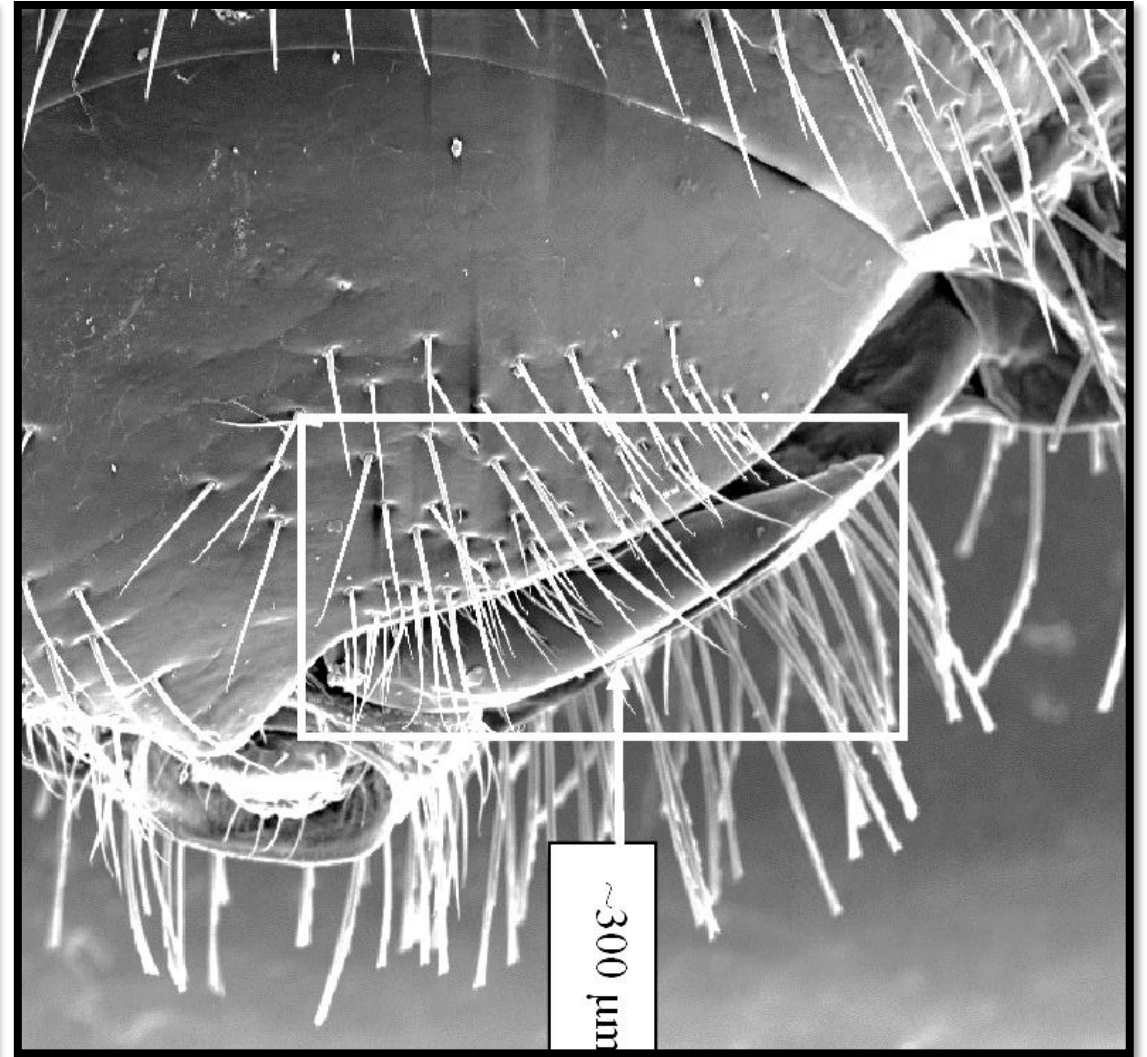
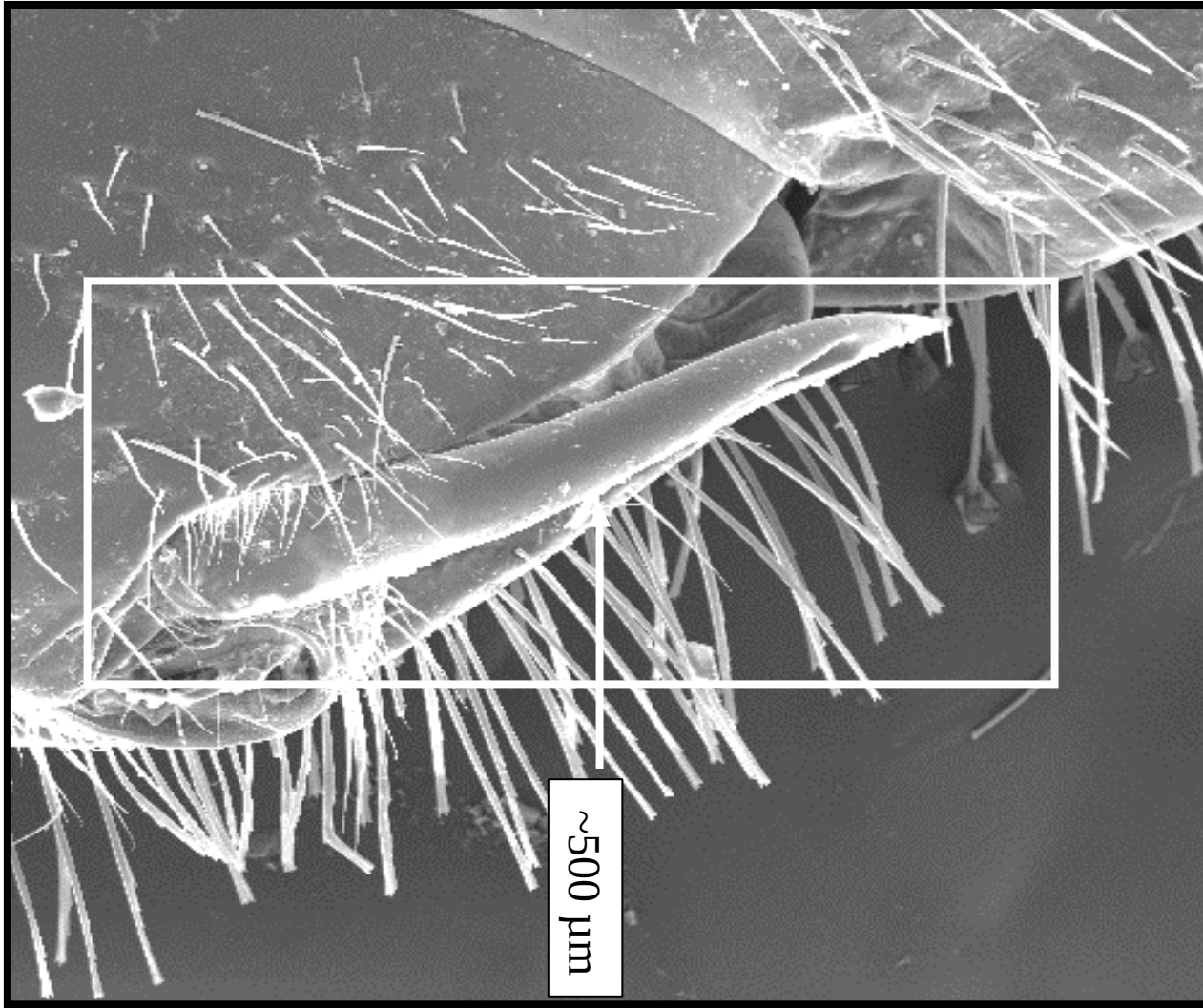
IGRs for bed bugs?

(IGRs: Insect Growth Regulators)

- **CSIs (Chitin Synthesis Inhibitors):**
Causing cuticle malformation during ecdysis.
(= molt)
- **JHAs (Juvenile Hormone Analogues):**
Affects multiple developmental processes.
Ecdysis and formation of reproductive organs.

CSIs (Chitin Synthesis Inhibitors):

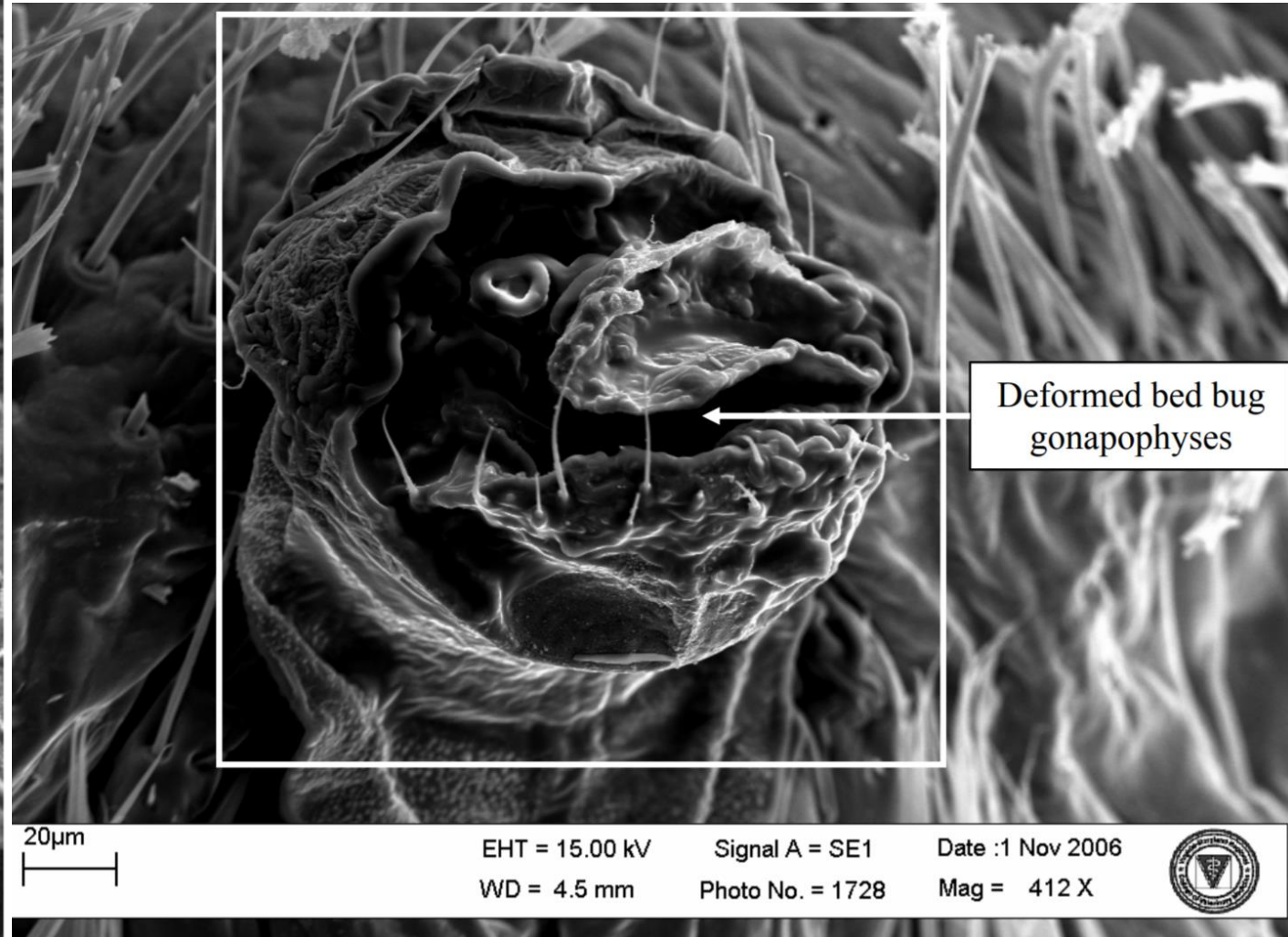
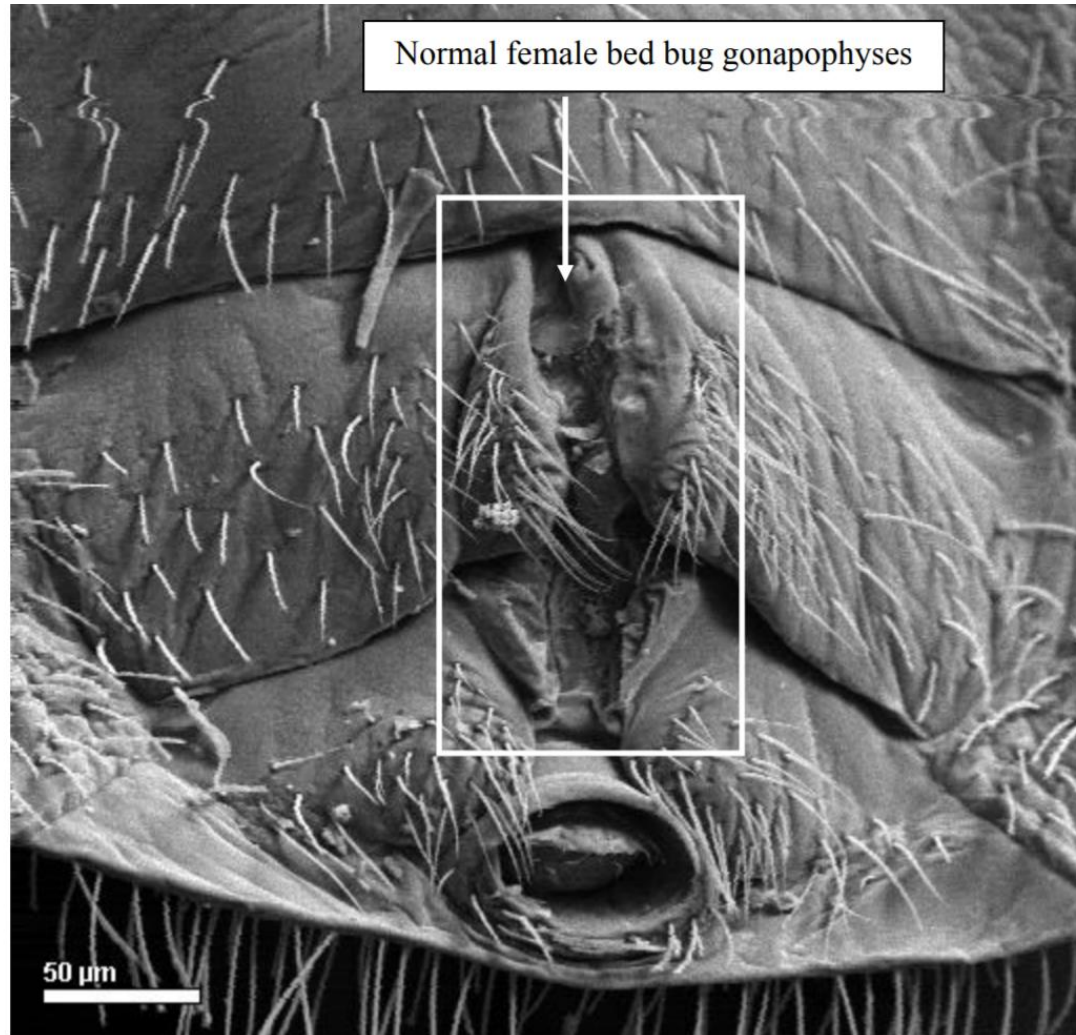
(Moor 2006)



"Deformed male paramere was 25% shorter"

CSIs (Chitin Synthesis Inhibitors):

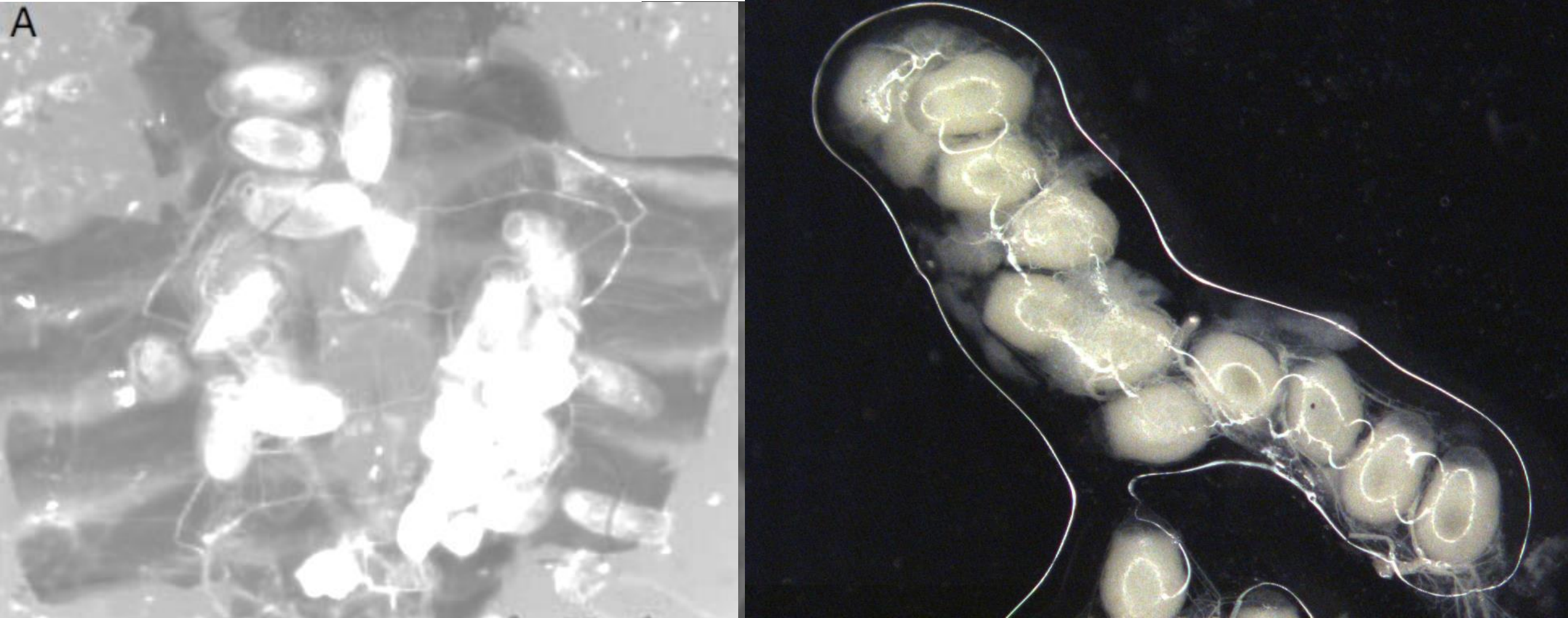
(Moor 2006)



“Female genitalia was completely deformed”

JHAs (Juvenile Hormone Analogues)

(Goodman et al. 2012)



“Eggs retained in the abdomen of treated females”

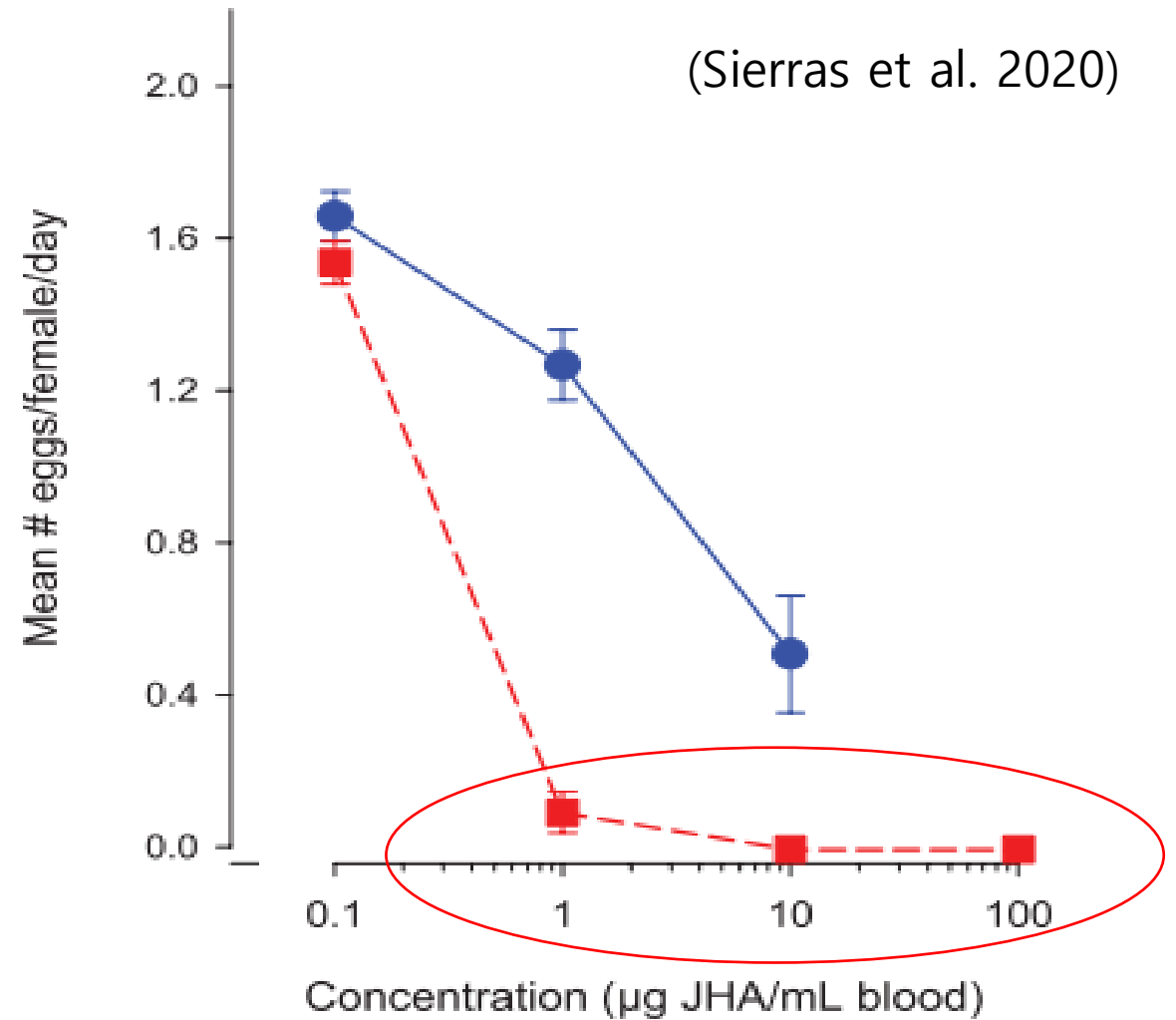
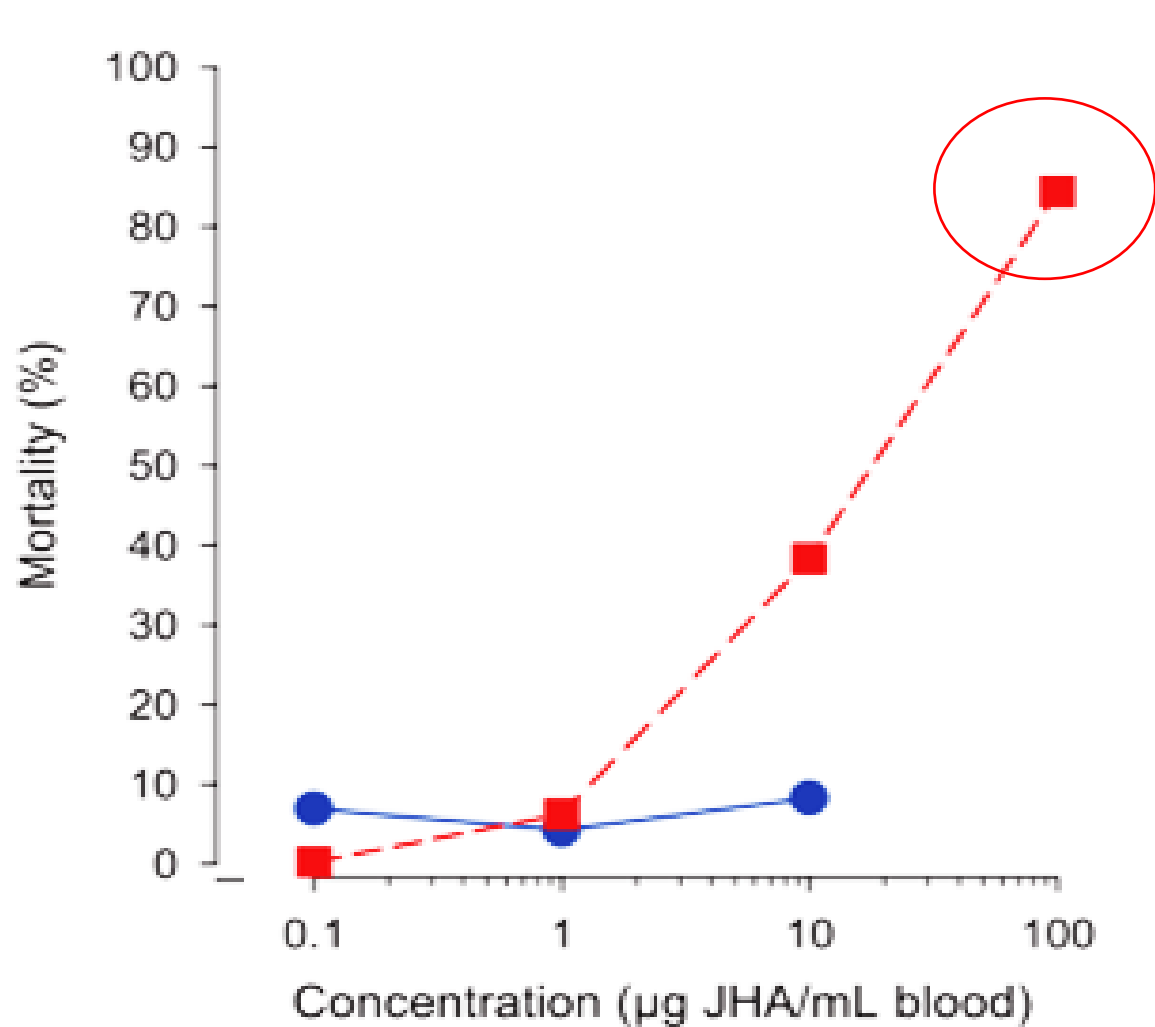
JHAs (Juvenile Hormone Analogues)

(Campbell et al. 2017)



*“Ruptured guts caused **molting failure**”*

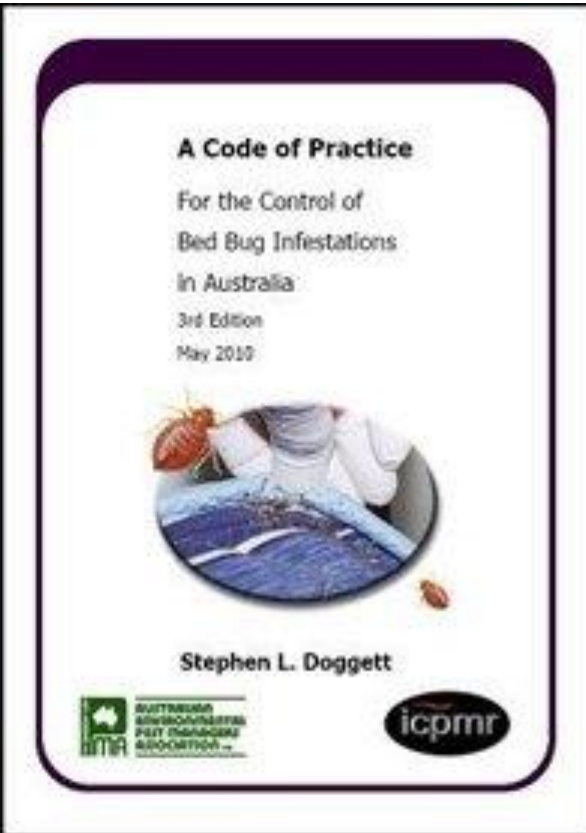
JHAs (Juvenile Hormone Analogues)



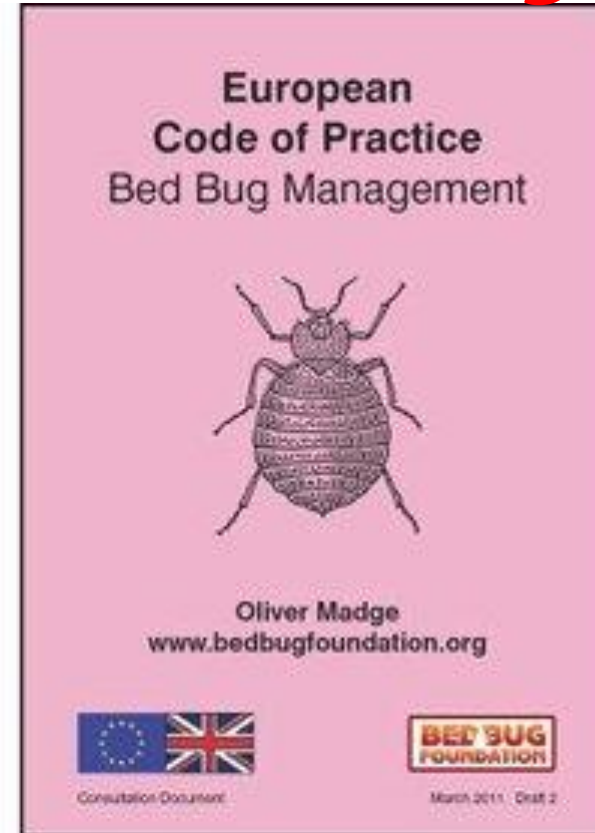
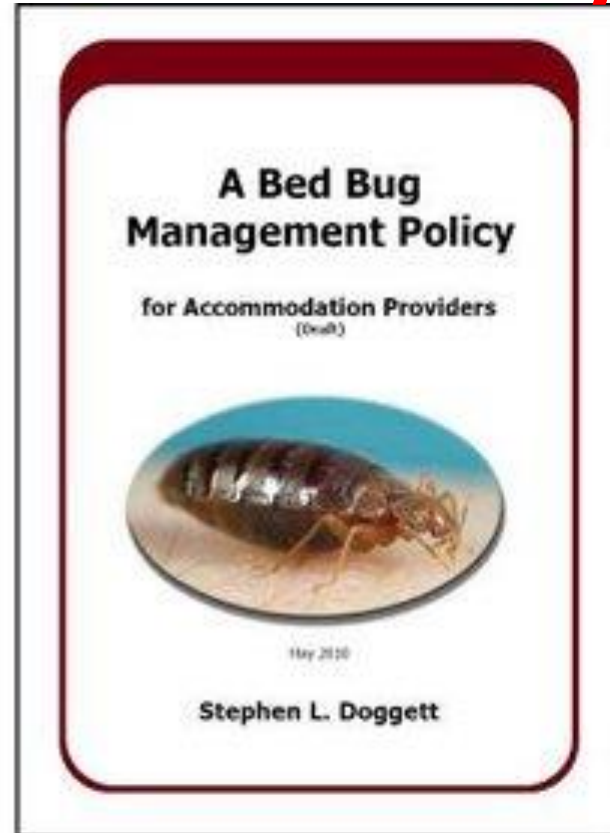
"84% mortality and inhibited oviposition"

“Industry standards in bed bug management”

What about tropical bed bugs?



Australia



Europe



United States
(Doggett et al. 2011)

Conclusion



“We need to be prepared.”