Mediterranean pine engraver, *Orthotomicus erosus*

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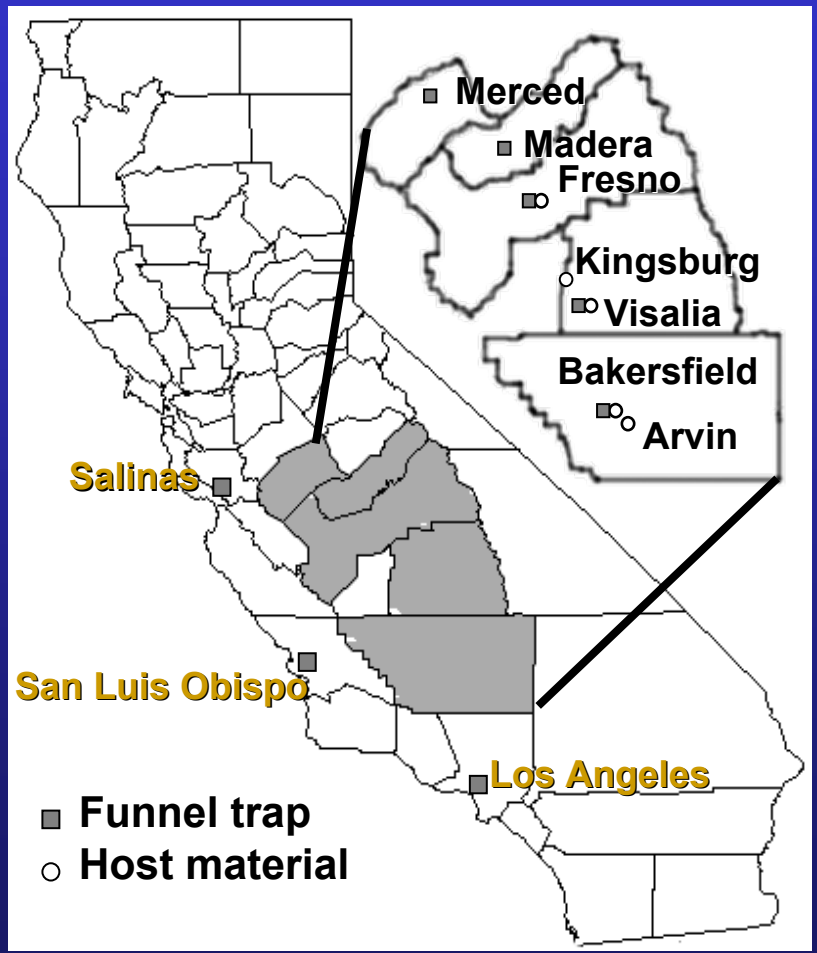
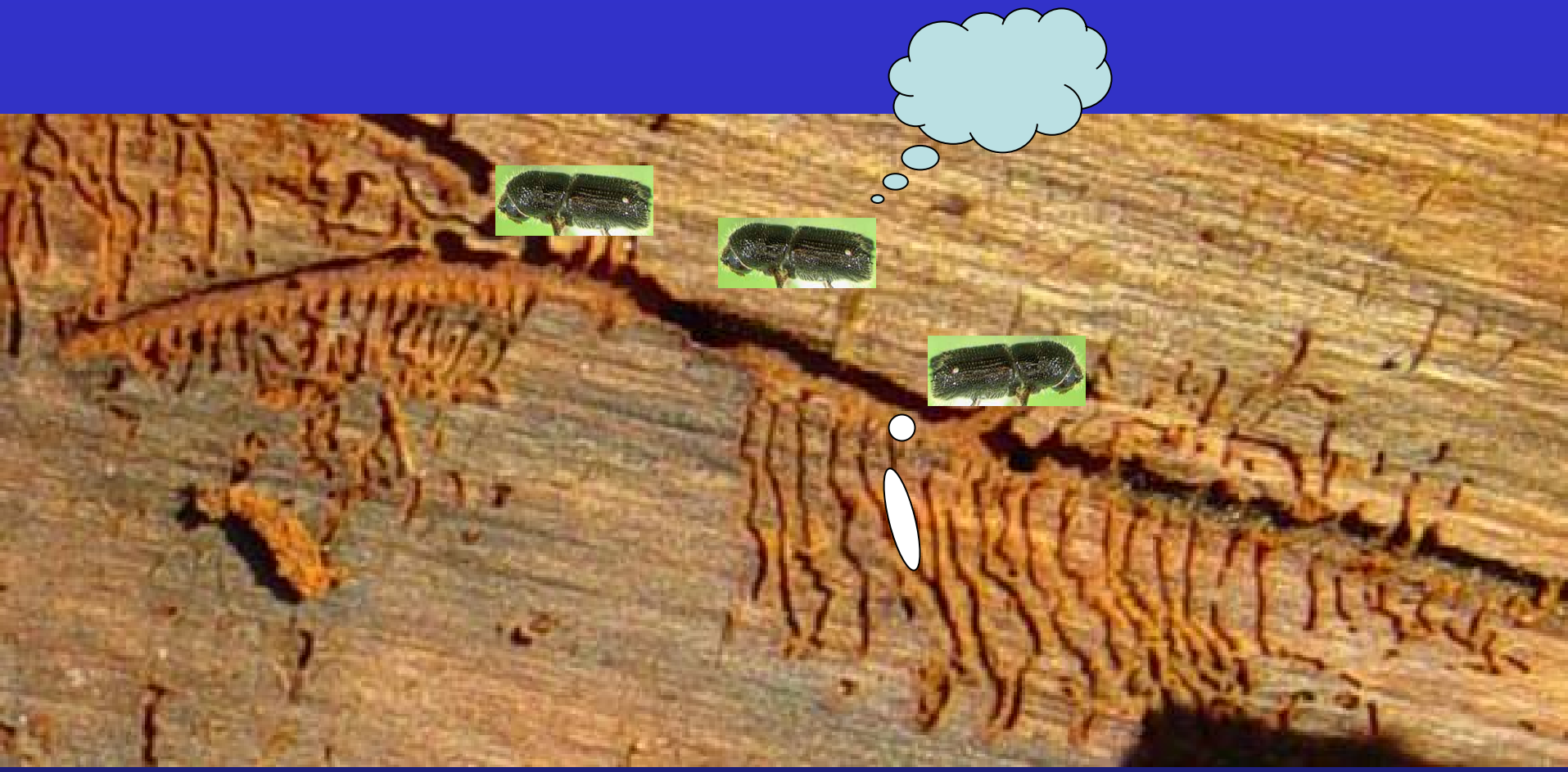
Invasive Mediterranean pine engraver (MPE)
Orthotomicus erosus

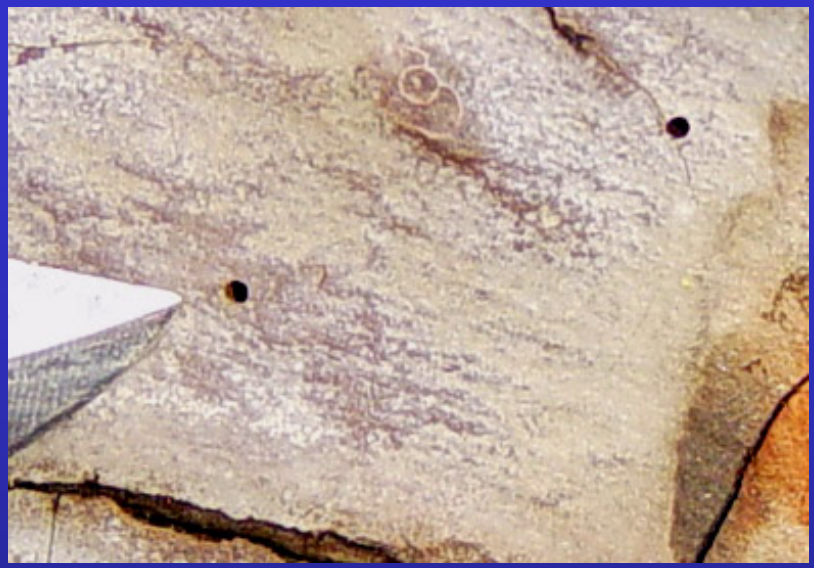


CA only place in N. America

- First detected May 25, 2004 Chaffee Zoo Fresno
- CDFA Pest Detection and Emergency Projects Branch


*MORE
MONTEREY
PINES
THIS WAY
MONTEREY
PINE



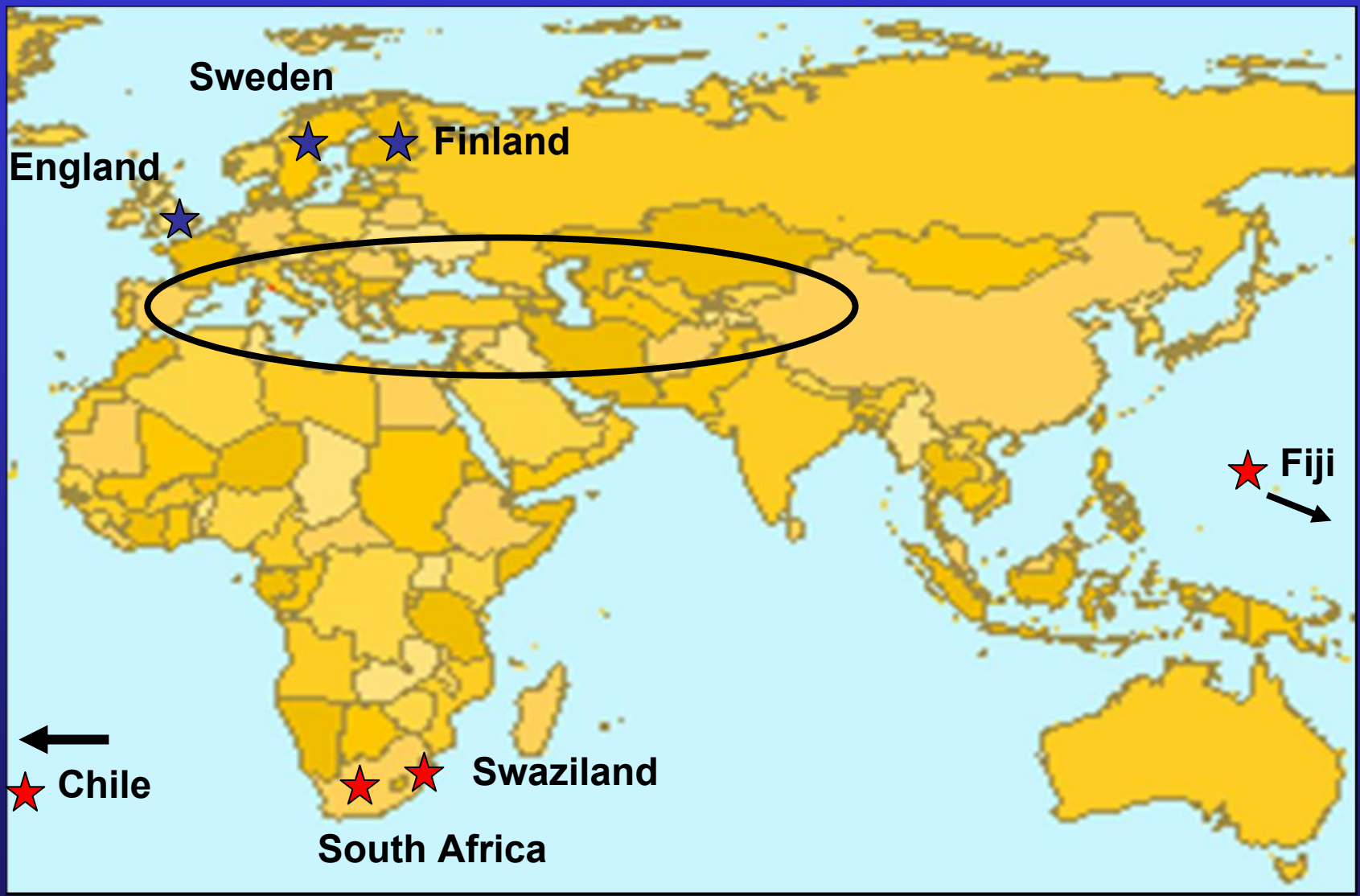


In California

- Overwinters as larvae, pupae and adults beneath bark surface
- Flight February-October/November
- First brood in mid March

Where are they from?

Also invaded



How MPE arrived here?

- 285 interceptions in U.S. ports 1985-2000
- 15 in CA among cargo from China, France, Korea and Portugal (Haack 2001)

Distribution Centers

Potential Impacts

- **Direct feeding on phloem**
- **MPE outbreaks during fire or drought stress**
- **South Africa beetle carry spores of *Graphium pseudormiticum* and the bluestain fungus *Ceratocystis ips***

Pines attacked by MPE common in the U.S.

Pines in western U.S.	
Monterey	*Pinus radiata*
Aleppo	*P. halepensis*
Italian stone	*P. pinea*
Canary Island	*P. canariensis*
Turkish	*P. brutia*
Coulter	*P. coulteri*
Afghan	*P. eldarica*
Pines in eastern U.S.	
Shortleaf	*P. echinata*
Slash	*P. elliottii*
Scots	*P. sylvestris*
Eastern white	*P. strobus*

Also found in Douglas fir, spruce and cedar

Goals

- Host range
- Identify fungal pathogens
- Attractant bait (detail)
- Identify inhibitors

Host range

Italian stone pine	Aleppo pine
Canary island pine	Ponderosa pine
Sugar pine	Monterey pine
Lodgepole pine	Loblolly pine
Jeffrey pine	Coulter pine
Douglas fir	Coast redwood
White fir	Incense cedar

1. # Emerged adults
2. Development time

Host range

Italian stone pine	Aleppo pine
Canary island pine	Ponderosa pine
Sugar pine	Monterey pine
Lodgepole pine	Loblolly pine
Jeffrey pine	Coulter pine
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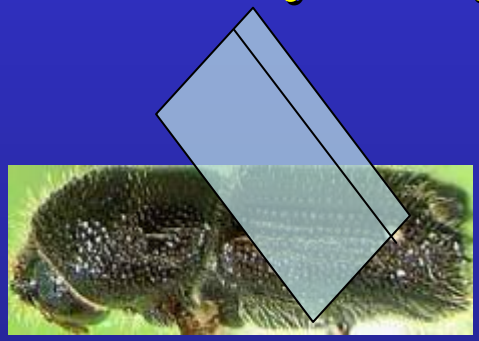
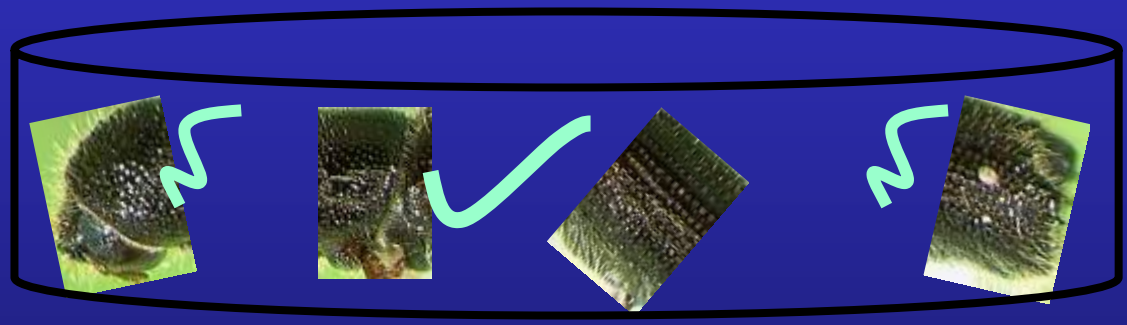
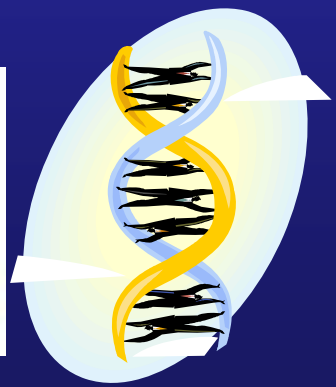
White fir	Incense cedar

Goals

- Host range
- **Identify fungal pathogens (Tom Harrington)**







Goals

- Host range
- Identify fungal pathogens
- **Attractant bait**

Literature

- GC-MS analysis of gas from hindguts of male infesting pine identified methylbutenol and ipsdienol (Geisen et al. 1984)

Flight trap studies

- Ipsdienol + methybutenol synergism (Geisen et al. 1984, Klimetzek & Vité 1986, Mendel 1988)
- Release rates ipsdienol (Klimetzek & Vité 1986)

Not completely substantiated

Attractant bait-Field studies 2005

1. Confirm synergism of methylbutenol and ipsdienol
2. Optimize methylbutenol release rate
3. Optimize ipsdienol release rate
4. Optimize ipsdienol enantiomeric blend
   racemic vs. (+) vs. (–)
5. Test synergism of ipsdienol enantiomeric blend and methylbutenol

1st Study-methylbutenol & ipsdienol synergism, response to host monoterpene α-pinene

- Blank
- α-pinene (Phero Tech)
- racemic ipsdienol (Phero Tech)

- 2-methyl-3-butenol (Phero Tech)
- racemic ipsdienol & methylbutenol
- racemic ipsdienol & methylbutenol & α-pinene

1st Study-methylbutenol & ipsdienol synergism, response to host monoterpene α-pinene

- Blank
- α-pinene (Phero Tech)

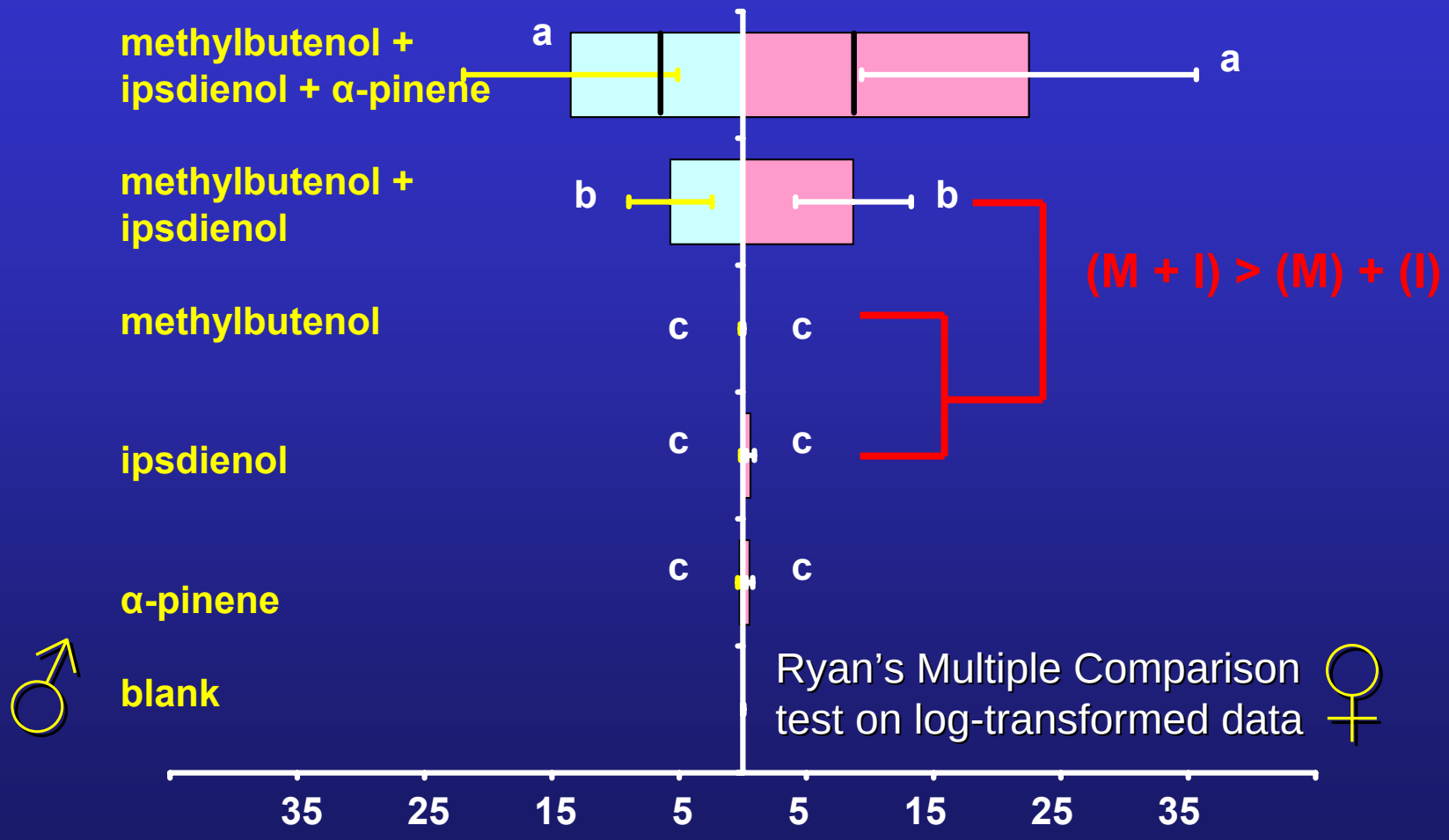
- racemic ipsdienol (Phero Tech)
- methylbutenol (Phero Tech)
- racemic ipsdienol & methylbutenol
- racemic ipsdienol & methylbutenol & α-pinene

Field experiments

4 blocks: Airways Golf Course (Fresno), Kings River Country Club (Kingsburg), Visalia Country Club, Valley Oaks Golf Course (Visalia)

- **Traps collected and re-randomized weekly or more frequently**
- **Feb. 7 – Mar. 18, 2005 (6 collections)**

MPE captured per week ± SE (Feb 7 - Mar 18)



ANOVA Males: Tx = 0.0001, block = 0.019, time = 0.35
Females: Tx = 0.0001, block =0.003, time = 0.0031, tx*time = 0.03

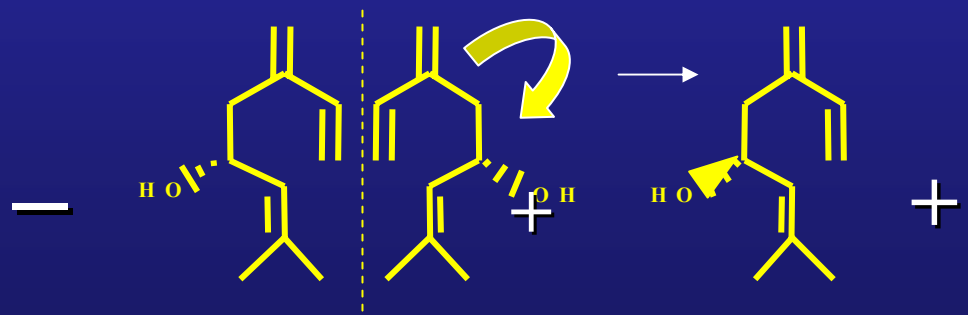
1st Study Feb7-Mar18	Racemic ipsdienol & methylbutenol synergistic, α-pinene maybe attractive
2nd Study Mar24-July15	Methylbutenol at low-med rates 0.5-60 mg/day
3rd Study July15-Sep2	1X Racemic ipsdienol 0.11 mg/day

4th Study-optimize ipsdienol enantiomeric blend

4th Study-optimize ipsdienol enantiomers

- Bait can have ipsdienol as racemic (economical), (+) or (–)

- MPE response to enantiomers ?
  1. Attracted to (+), inhibited by (–)
  2. Attracted to (+), no response to (–)
  3. Attracted to both (+) and (–)



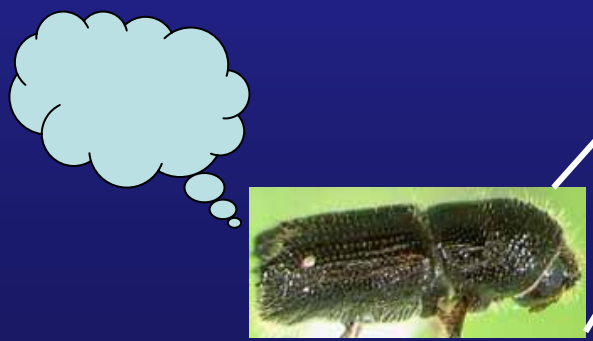
racemic = half (+) and half (–)

4th Study-optimize ipsdienol enantiomeric blend
compare to natural pheromone

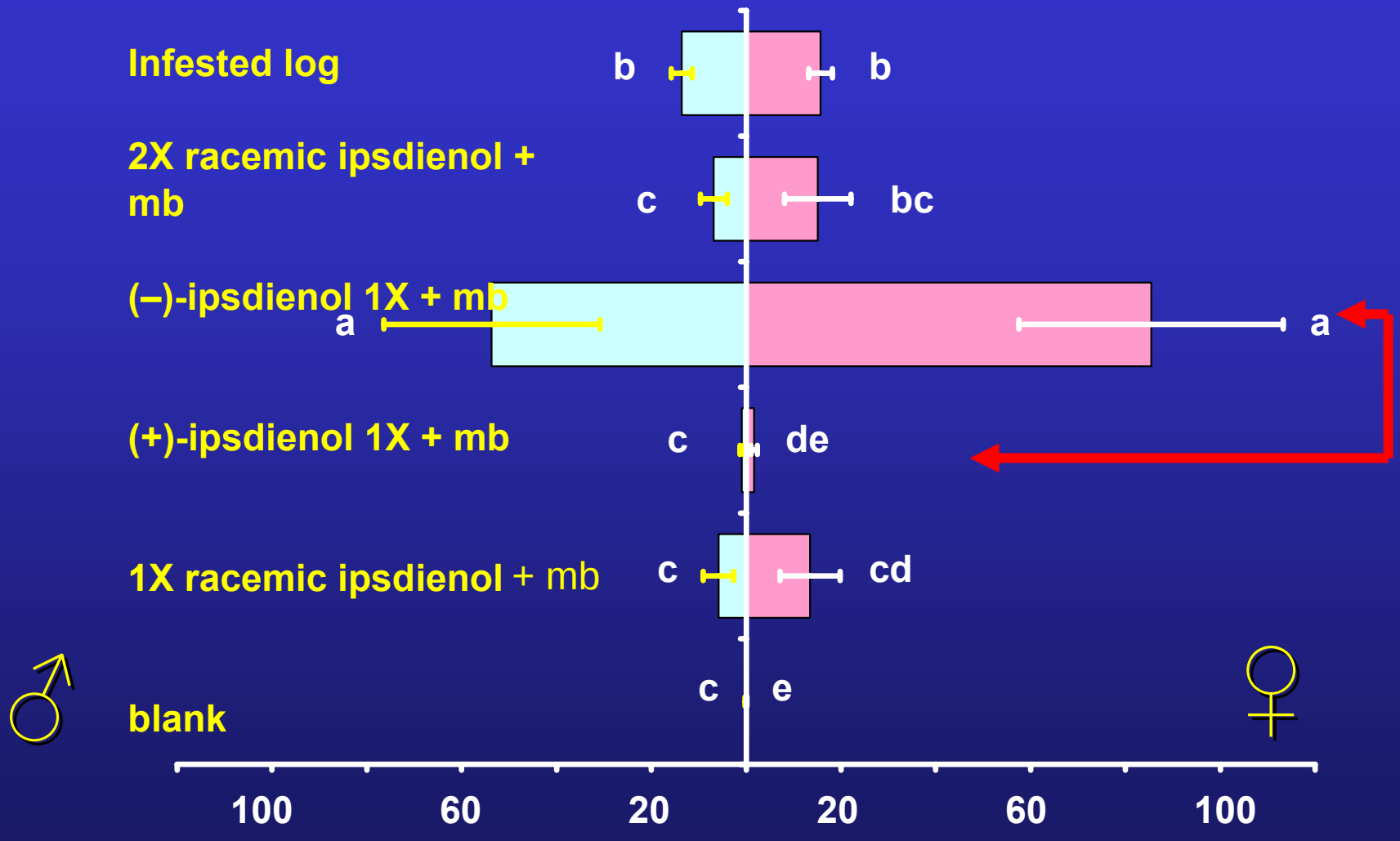
- blank
- med. methylbutenol, 1X racemic ipsdienol
- med. methylbutenol, 1X (+)-ipsdienol
- med. methylbutenol, 1X (–)-ipsdienol
- med. methylbutenol, 2X racemic ipsdienol
- infested log with 25 male MPE

4th Study-optimize ipsdienol enantiomers compare to natural pheromone

- blank
- med. methylbutenol, 1X racemic ipsdienol
- med. methylbutenol, 1X (+)-ipsdienol
- med. methylbutenol, 1X (–)-ipsdienol
- med. methylbutenol, 2X racemic ipsdienol
- **log infested with 25 male MPE**

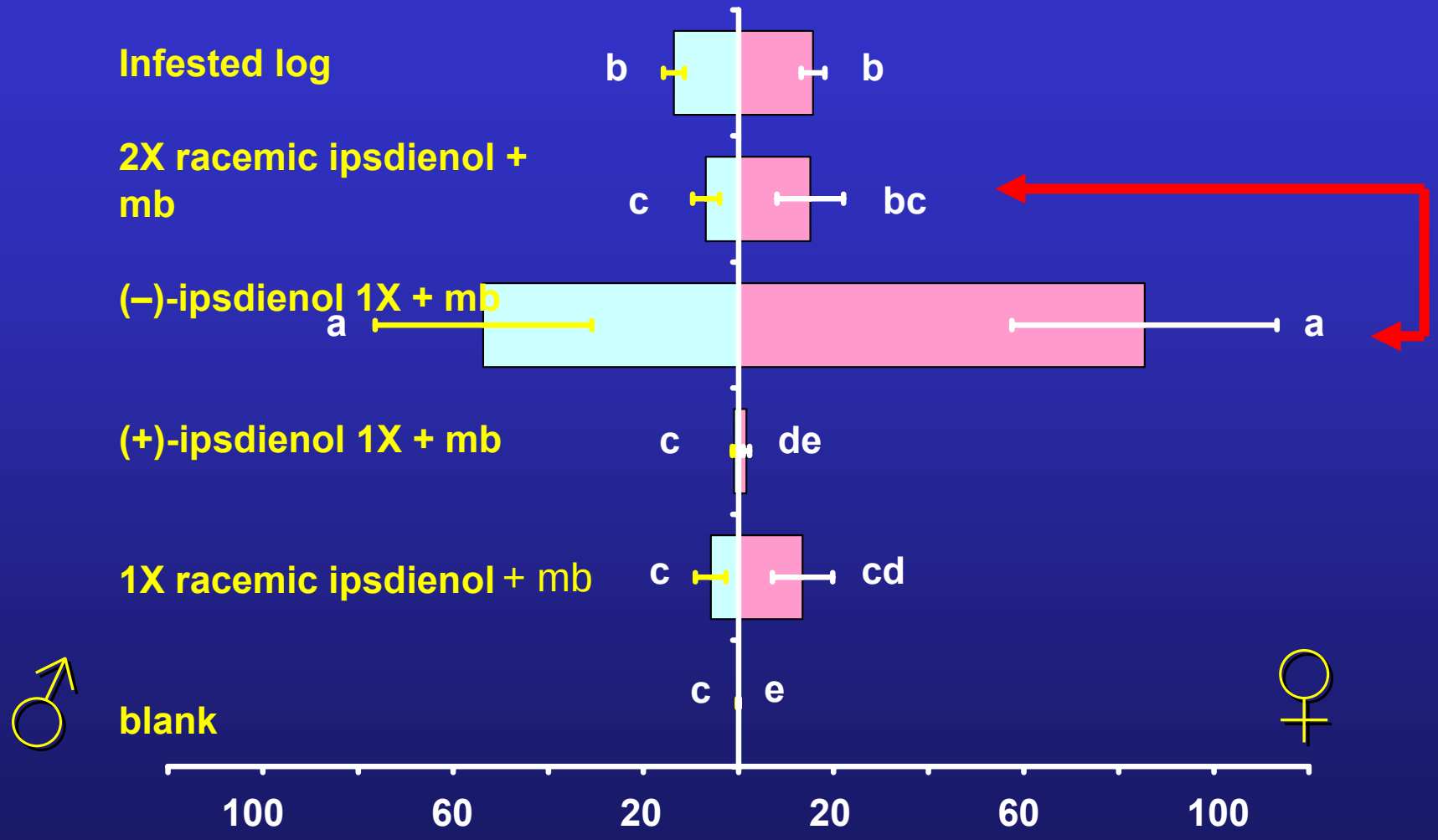


MPE captured per week ± SE (Sep 2-Sep 23)



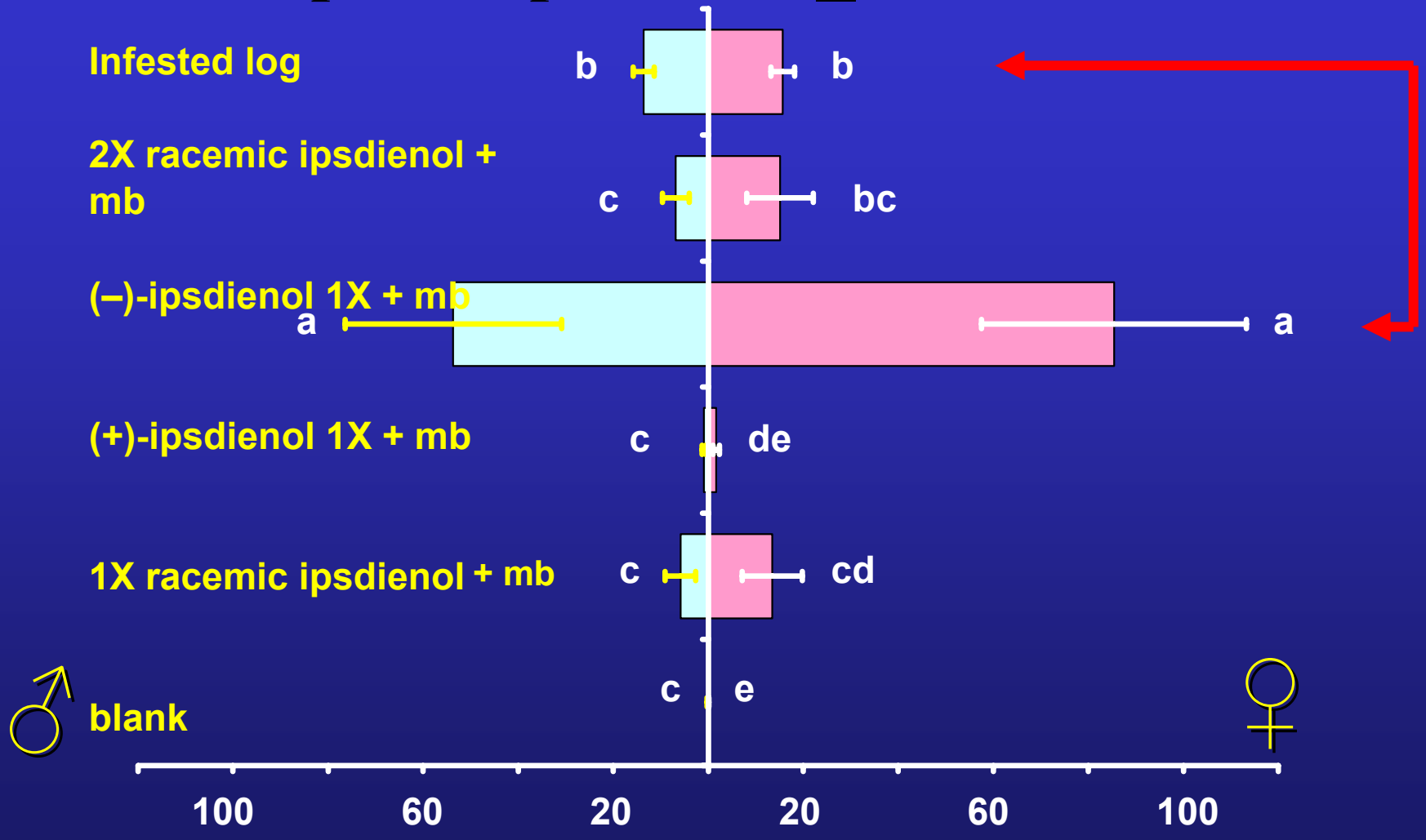
Males: Tx = 0.0001, block = 0.0001, time = 0.27
Females: Tx = 0.0001, block =0.0001, time = 0.831

MPE captured per week ± SE (Sep 2-Sep 23)



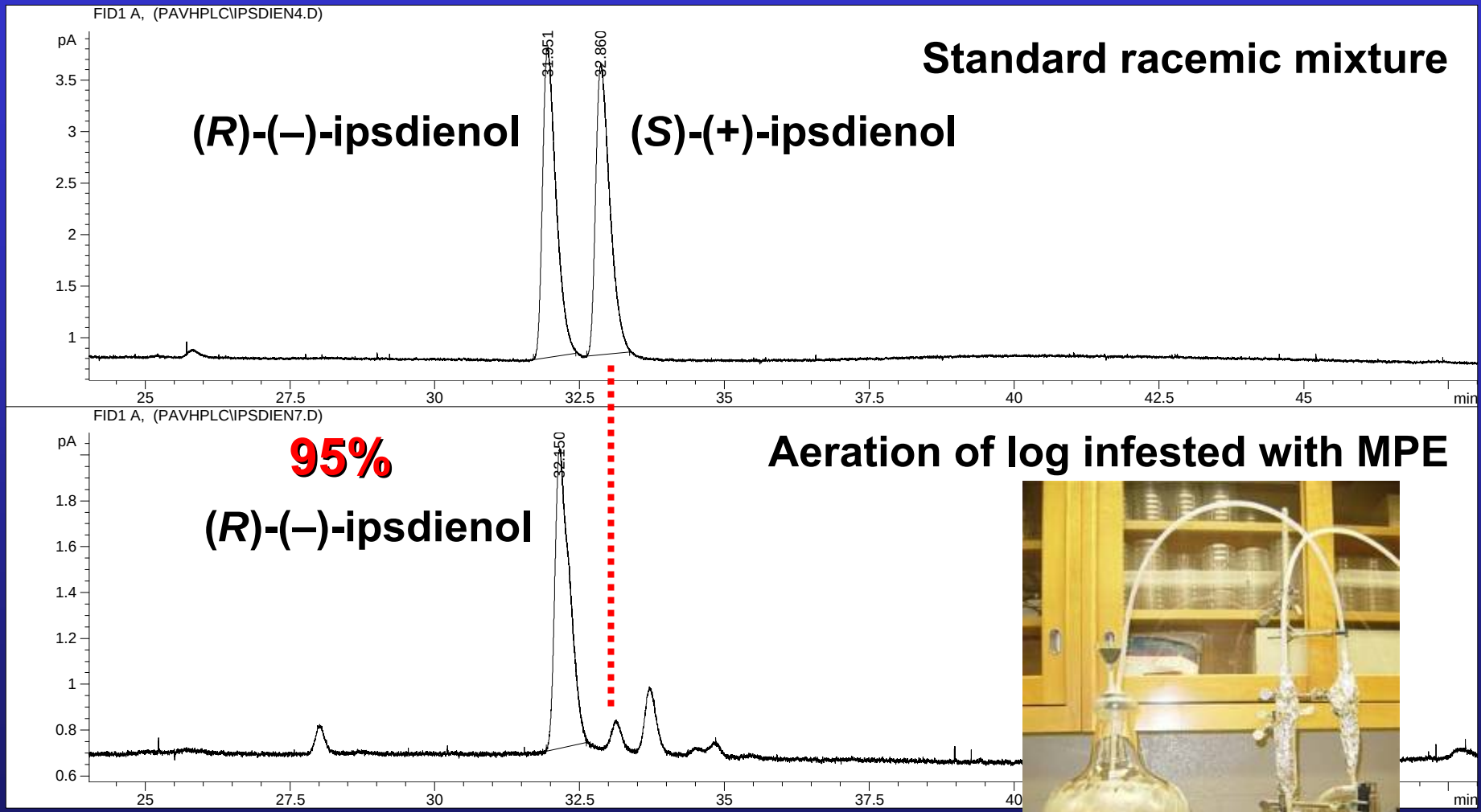
Males: Tx = 0.0001, block = 0.0001, time = 0.27
Females: Tx = 0.0001, block =0.0001, time = 0.831

MPE captured per week ± SE (Sep 2-Sep 23)



Males: Tx = 0.0001, block = 0.0001, time = 0.27
Females: Tx = 0.0001, block =0.0001, time = 0.831

Pheromone aeration

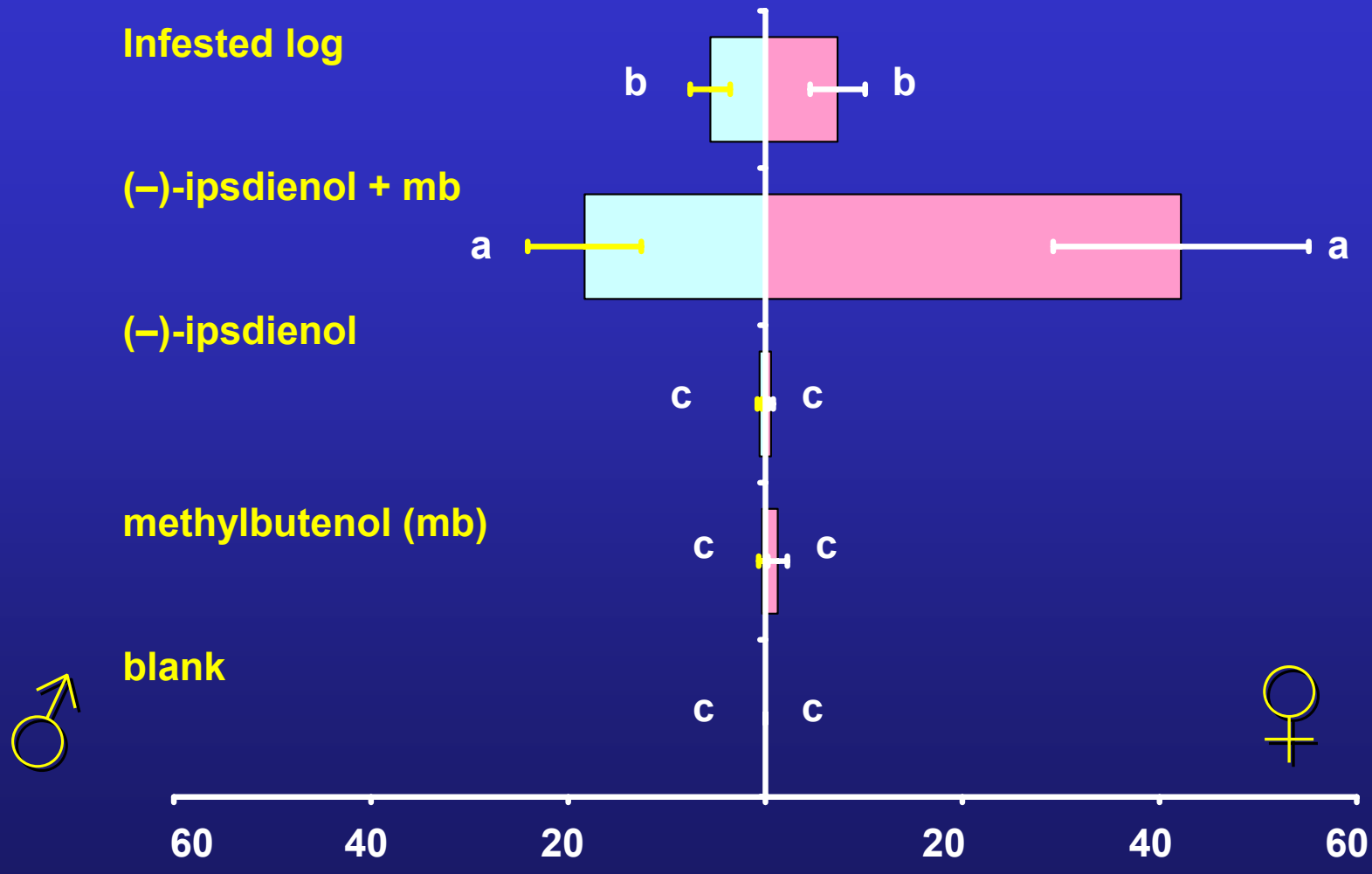


4th Study (–)-ipsdienol attracts, (+) inhibits

5th -synergism methylbutenol and (–)-ipsdienol

- Blank
- methylbutenol
- (–)-ipsdienol
- methylbutenol, (–)-ipsdienol
- log infested with 25 male MPE

MPE captured per week ± SE (Sep 23-Oct 18)



Males: Tx = 0.0001, block = 0.0004, time = 0.007, tx*time = 0.025
Females: Tx = 0.0001, block =0.0001, time = 0.015

Summary

1st Study Feb7-Mar18	Racemic ipsdienol & methylbutenol synergistic, α-pinene maybe attractive
2nd Study Mar24-July15	Methylbutenol at low-med rates 0.5-60 mg/day
3rd Study July15-Sep2	1X Racemic ipsdienol 0.11 mg/day
4th Study Sep 2-Sep23	(–)-ipsdienol attracts, (+) inhibits (–)-ipsd. & methyl. > natural pheromone
5th Study Sep23-Oct18	(–)-ipsdienol & methylbutenol synergistic (–)-ipsd. & methyl. > natural pheromone

Goals

- Host range
- Identify fungal pathogens
- Attractant bait
- **Identify inhibitors**

Identify inhibitors

Literature: verbenone and possibly *cis*-verbenol inhibited MPE (Paiva et al. 1988)

blank

bait

bait + inhibitor A

bait + inhibitor B

bait + inhibitor C

→ reduce funnel trap capture similar to blank

Acknowledgements

- UC Davis: Peter Cranston, Kent Daane, Eugenel Espiritu, Mary Louise Flint, Jamie Lascinia
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- USDA Forest Service Pacific Southwest Research Station