OP-171 [Bee Health]
Disinfection and antimicrobial management of European foulbrood disease reservoirs

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Background
Clinical outbreaks of European foulbrood (EFB), a stress-associated, bacterial disease of honey bee larvae, continue to be unpredictable and costly for Canadian beekeepers. The natural reservoir for the causative bacterium, Melissococcus plutonius, is poorly understood, with adult bees and hive equipment potential candidates. Accordingly, investigation of the persistence of M. plutonius in adult bees and beekeeping equipment, as well as appropriate decontamination and antimicrobial management strategies, are urgently needed to decrease EFB risk and reoccurrence.

Methodology
To investigate adult bees as a reservoir for M. plutonius, we inoculated both honey bee worker larvae and adult bees in vitro with incremental doses of M. plutonius and monitored their survival and bacterial load over time as adult bees, as well as the impact of antimicrobial treatment on bacterial load. Additionally, we determined the bacterial load of larvae and adult bees sampled from colonies with clinical EFB, before and after antimicrobial or sham treatment. To investigate hive equipment as a reservoir for M. plutonius, hive matrices, including metal, wood, and comb, were inoculated with incremental doses of M. plutonius and bacterial recovery was evaluated over time. In parallel, we determined the efficacy of decontamination, including soap, bleach, alcohol, and radiation, on bacterial recovery from inoculated hive material.

RESULTS: We found that adult bees remained persistently colonized with M. plutonius, which significantly decreased their lifespan in vitro. Antimicrobial treatment improved adult bee survival after M. plutonius inoculation; however, treated adult bees still remained persistently colonized. Moreover, antimicrobial treatment of colonies with clinical EFB did not decrease bacterial load of adult bees and larvae. Evaluation of M. plutonius persistence and decontamination from hive equipment is in progress.

Significance
Adult bees and larvae remain persistently colonized with M. plutonius, in spite of antimicrobial treatment and clinical resolution of EFB, emphasizing their role as a reservoir for this disease. Adoption of decontamination methods for M. plutonius in hive equipment may be an effective strategy to reduce the M. plutonius reservoir within colonies, and thereby decrease the incidence of EFB, as well as decrease the reliance on antimicrobials for EFB treatment in Canada.

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My ‘Bee Family’

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Prince Edward Island WILD BLUEBERRY Growers Association
OBA
ONTARIO BEEKEEPERS' ASSOCIATION
Since 1881
SPBQ
Syndicat des Producteurs de Bleuets du Québec
NEW BRUNSWICK BEEKEEPERS ASSOCIATION
ASSOCIATION DES APICULTEURS DU NOUVEAU-BRUNSWICK
NBBA·AANB
Government of Saskatchewan

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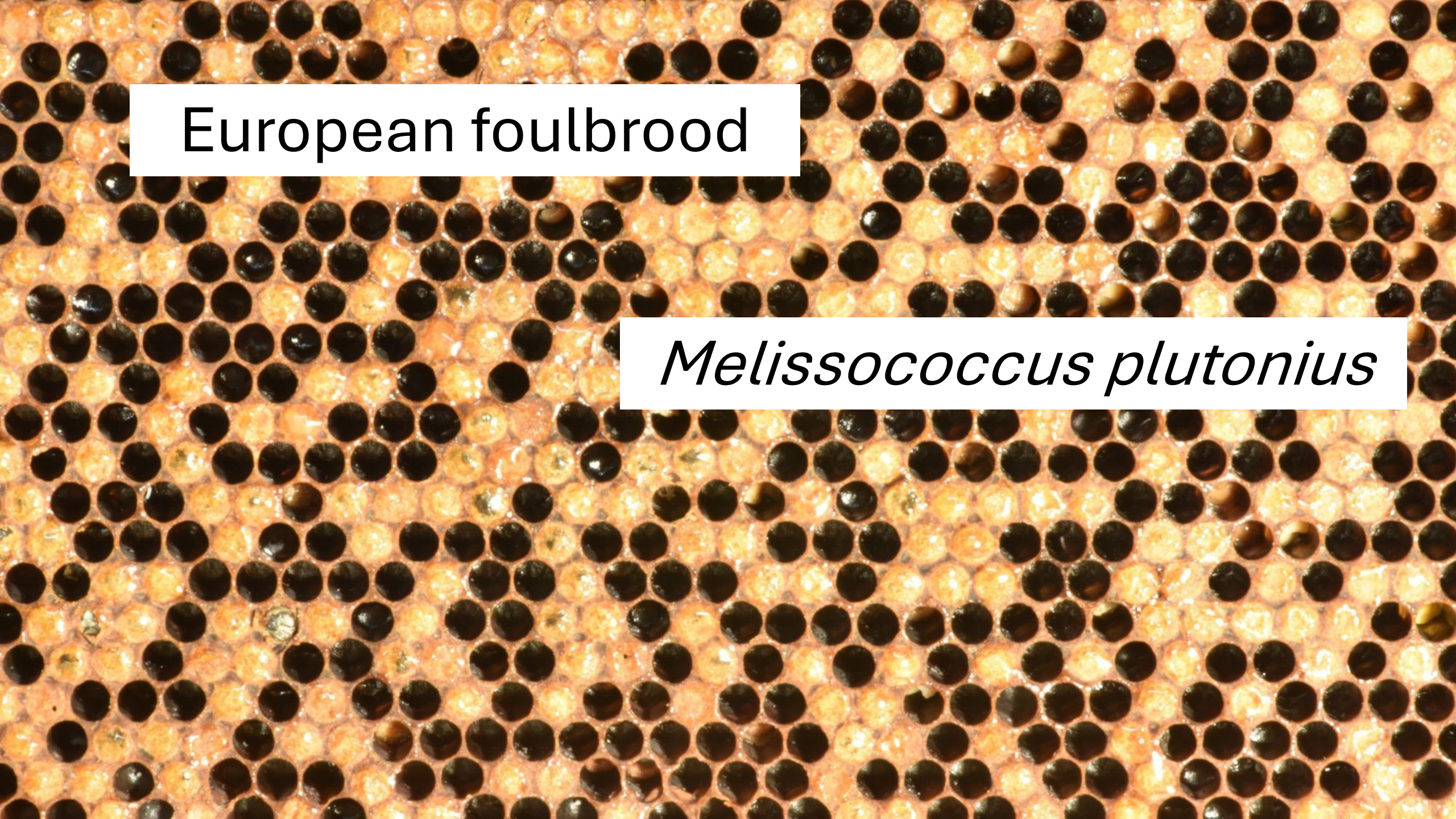
https://www.nationalgeographic.com/history/article/typhoid-mary-tragic-tale-exposed-health-impacts-super-spreaders


European foulbrood
Melissococcus plutonius

‘Typhoid Mary’ worker

STRESS

EFB Reservoirs

‘Typhoid Mary’ worker

https://extensionaus.com.au/professionalbeekeepers/old-comb-a-less-productive-colony/

http://articles.extension.org/sites/default/files/w/7/70/EFBBrownlarvae.jpg

Can infected larvae survive to become workers that carry EFB?

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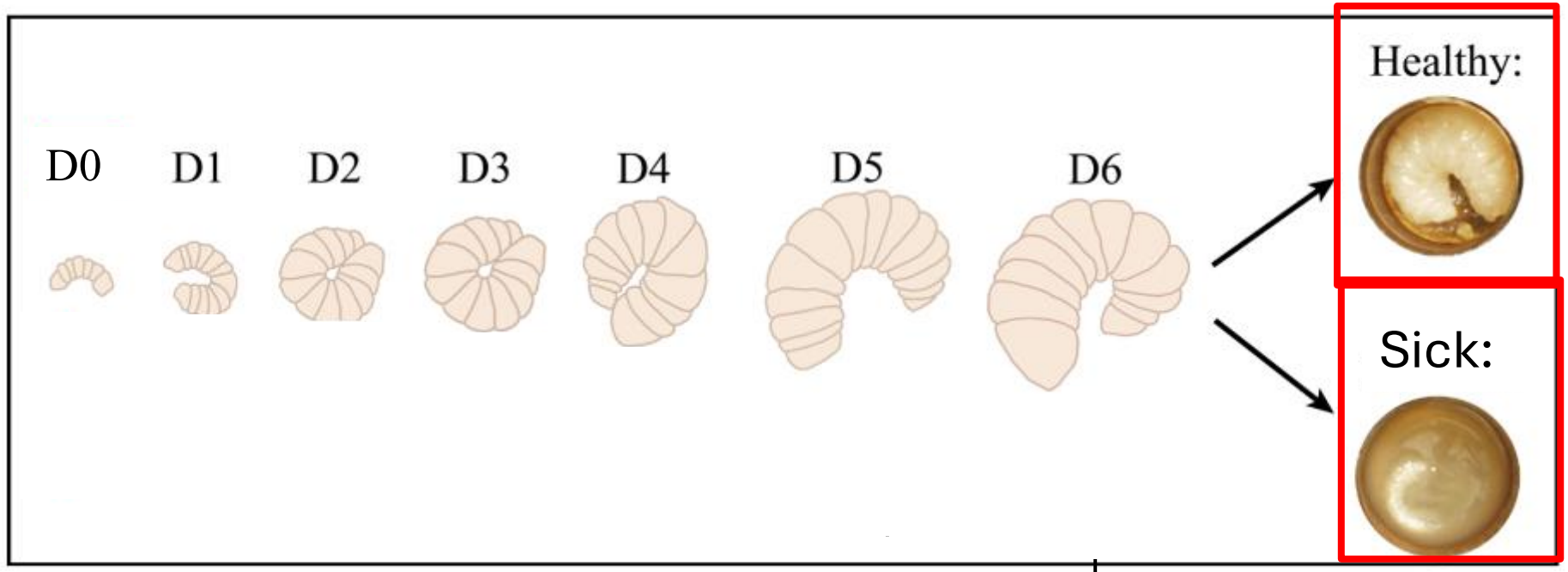


Infect
50 CFU
M. plutonius

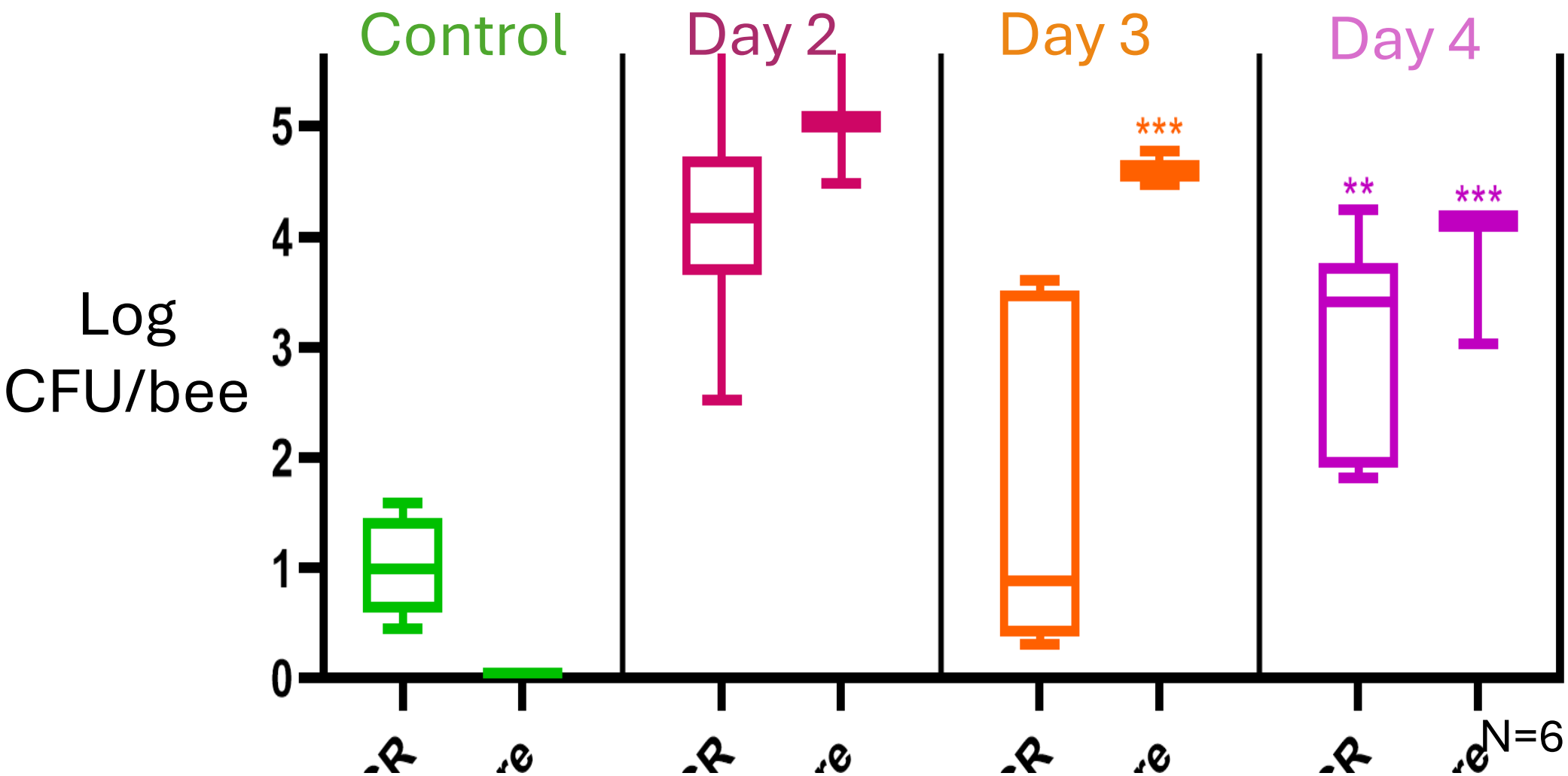
Jennifer Svilik

Dr. Yashoda Wickramasinghe

Masood et al., Sci Rep, 2022

Delayed infection increases survival to adulthood

Adult bees carry *M. plutonius*



N=6 bees per group

** $p < 0.01$

*** $p < 0.001$

Can infected larvae survive to become workers that carry EFB?

YES

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How do we minimize disease spread?

- Quarantine
- Sanitation
- Antimicrobials*

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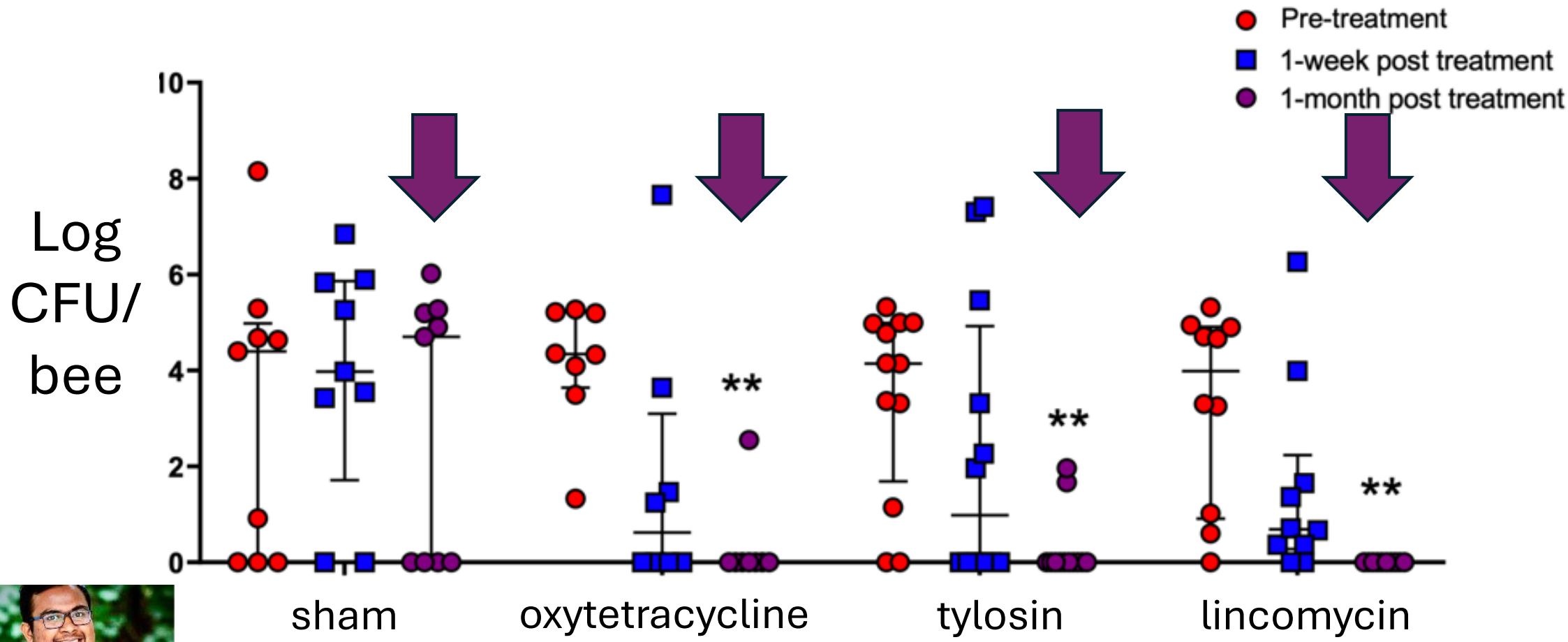
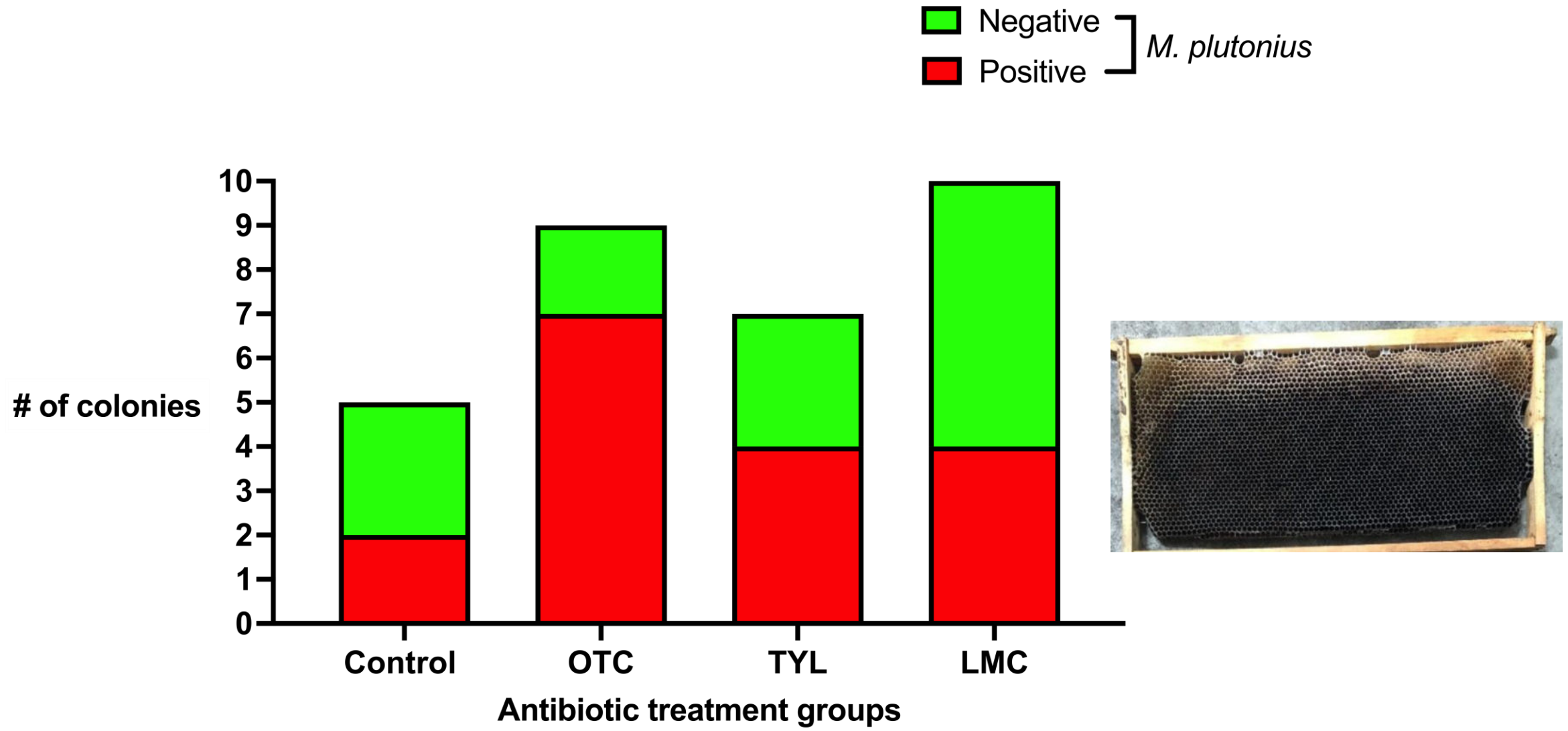
Antibiotic treatment decreases infected workers



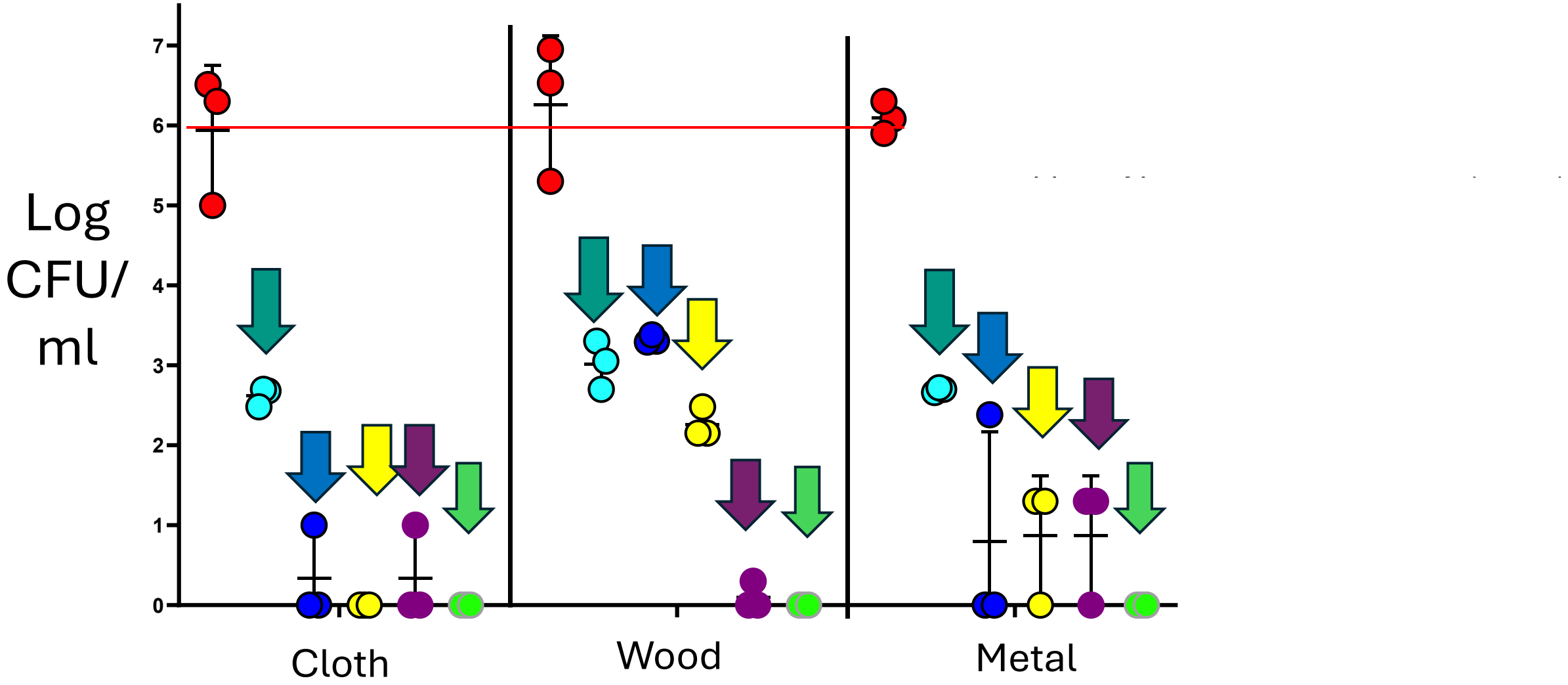
Dr. Midhun Jose

** $p < 0.01$
N=12 colonies/group

Equipment remains a disease reservoir 1-year later



Common disinfectants decrease EFB in equipment



+ 5% honey, 1% BSA, 1% yeast + 1,000,000,000 *M. plutonius* (log 9 CFU/ml)

- Adult workers can carry EFB
- Antimicrobials decrease but do not eliminate carrier workers
- Practical equipment disinfection options exist

To prevent European foulbrood, we must manage the disease reservoir