OP-154 [Bee Health]
Viral Infections: When and How Do Honey Bee Queens Become Infected

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Viruses constitute a major class of honey bee pathogens, with most being +ssRNA and posing significant health concern. They employ various transmission routes and infect queens at different developmental stages. Therefore, understanding transmission pathways and identifying the most vulnerable stages of queen development to viral infections are essential for reducing or preventing viral infections. To address this, we conducted a series of controlled experiments and surveys in commercial queen-producing operations, covering the entire queen-production process. Using the RT-qPCR approach, we tested seven honey bee viruses including DWV type A and B, BQCV, LSV, CBPV, SBV, and IAPV. Our findings highlight the critical role of vertical and venereal transmission in queen infections, regardless of virus type. Queens are highly vulnerable in their early development, highlighting the importance of selecting healthy breeder queens. Although we detected high virus loads in nurse bees, virus levels in royal jelly were very low or undetectable, suggesting that the vertical transmission from infected breeder queens is the primary pathway for viral spread. Additionally, we found that mated queens carried significantly higher virus loads than virgin queens, highlighting mating as another critical transmission point. This finding emphasizes the need to produce healthy mature drones during queen mating period. Furthermore, virus loads in queens were consistently higher in banked colonies compared to mating nucs, suggesting that the practice of queen banking may contribute to increased virus levels in honey bee queens.

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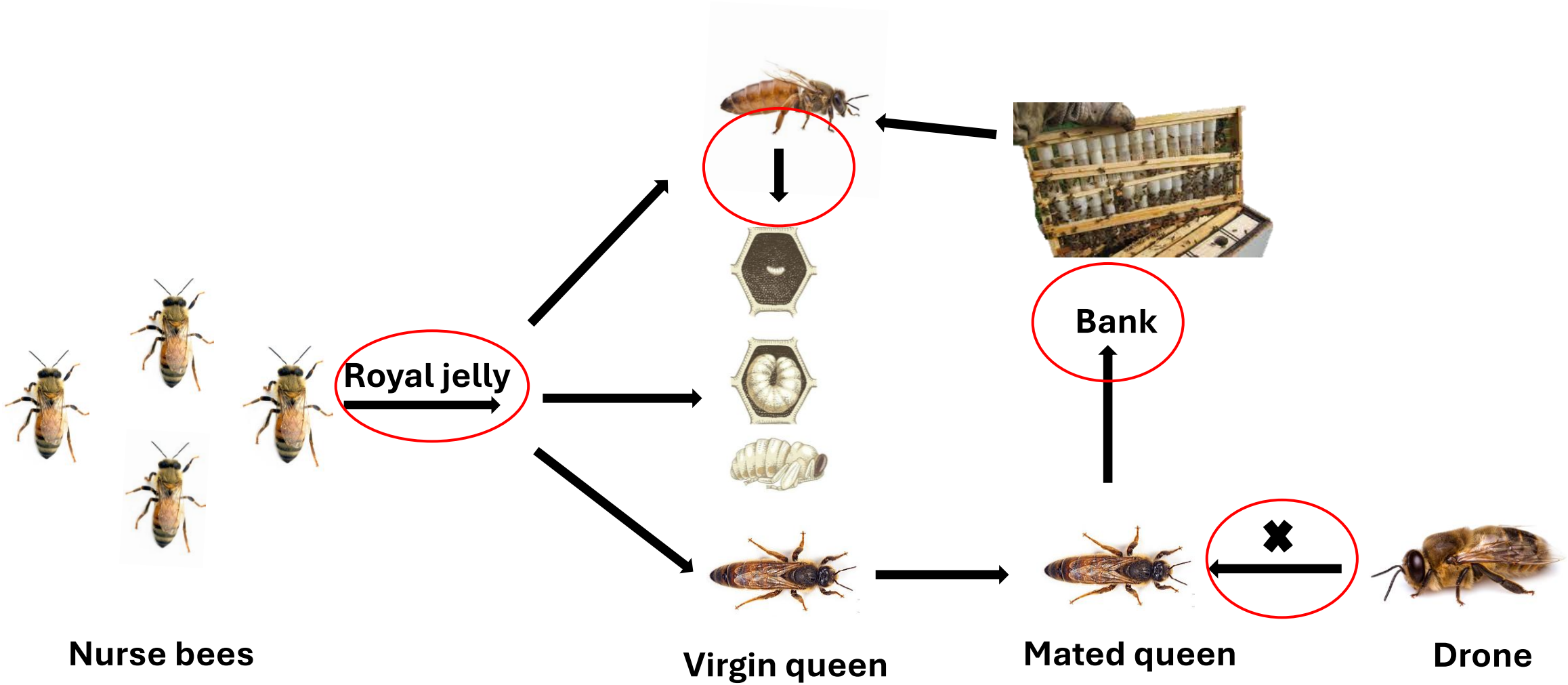
Introduction

- Understanding transmission routes and critical stages is key to preventing virus infections.

- Viruses negatively impact reproduction, pheromone profile, and lifespan.

Gauthier et al., 2011; Amiri et al., 2017; Orlova et al., 2023; Chapman et al., 2024

When are queens vulnerable to viral infections?



Sampling

Breeder Colony

Nurse Colony

Egg Samples
Worker Bees

→

Queen Larvae
Royal Jelly
Worker Bees

→

Queen Pupae
Virgin queens

→

Mated queens
Worker bees
Drones

→

Mated queens
Worker bees

(n= 5 colonies/ operation)

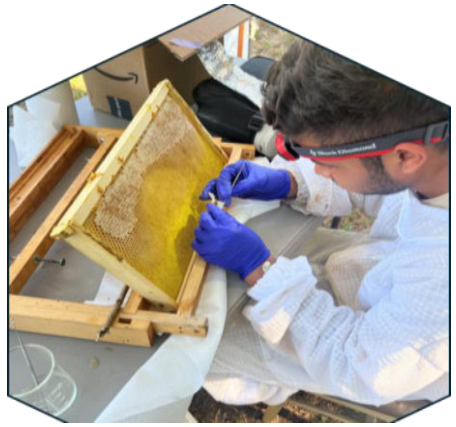
(n= 5 larvae/ Operation)

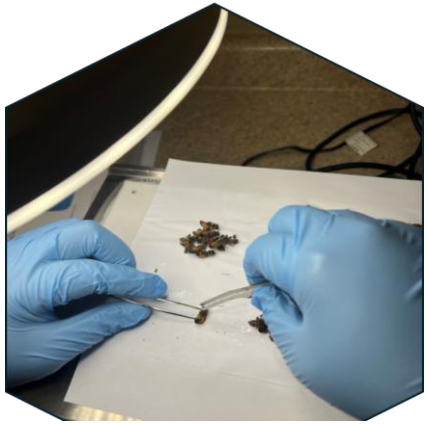
(n=5 from each/ operation)

(n= 5 queens
n= 10 drones
n=5 pools of 10 drones /operation)

n= 10 queens/ Operation)

Methodology





Sampling:

- 10 commercial queen producers in Mississippi and Louisiana
- 2 years sampling

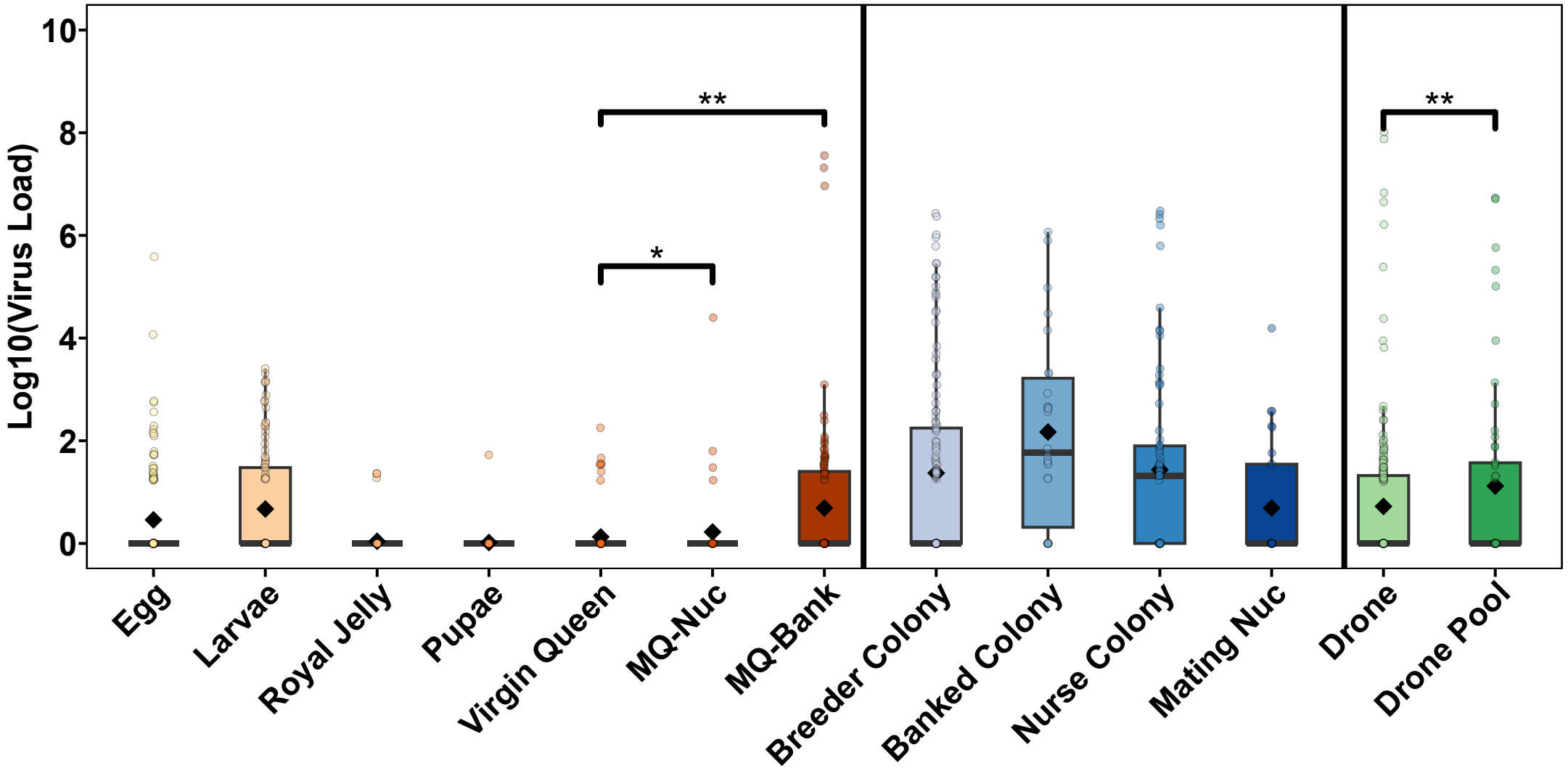
Molecular assay:

- RT-qPCR
- 4 viruses: DWV-A&B, BQCV, LSV

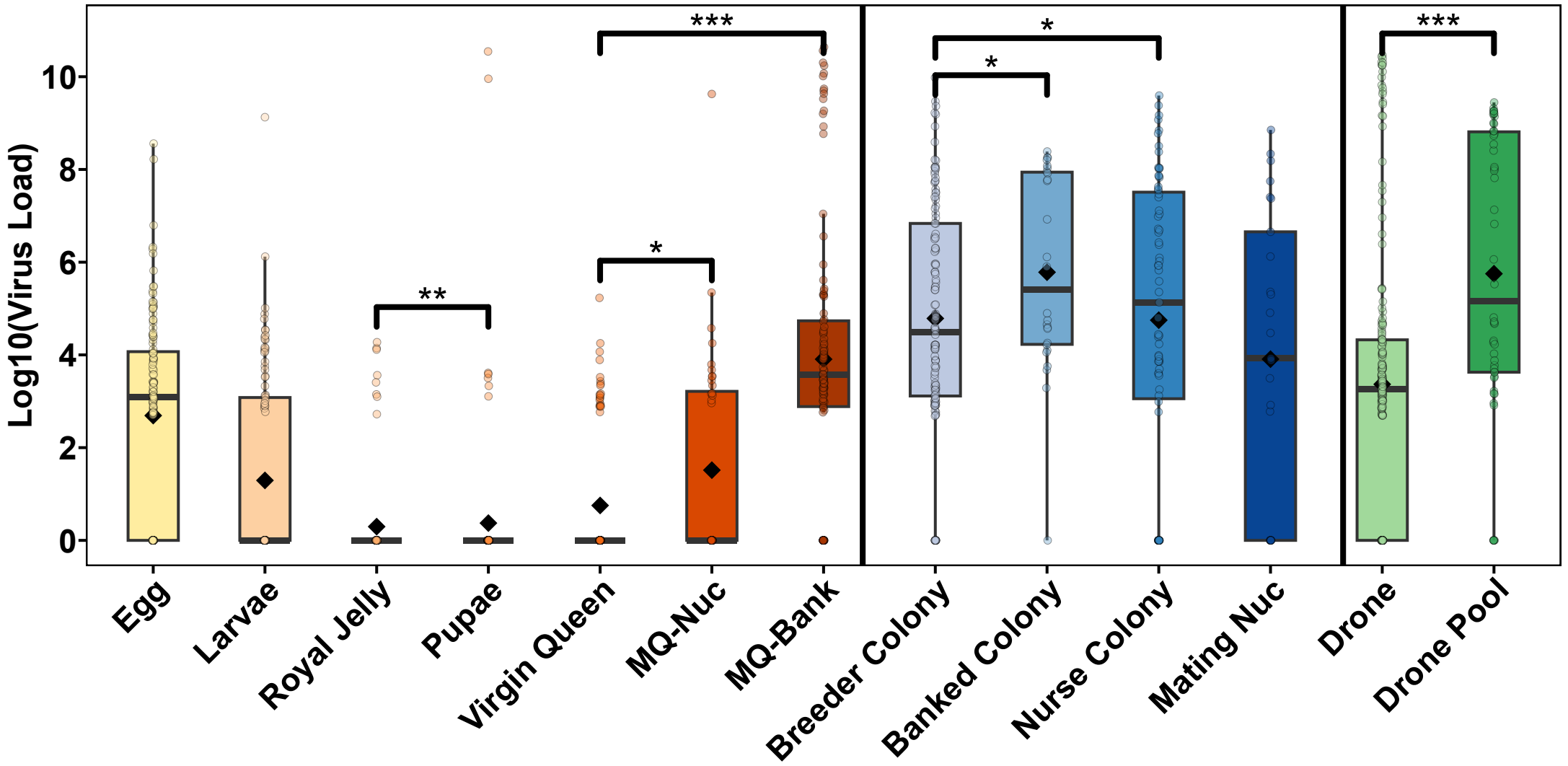
Statistical approaches:

- Bayesian Generalized Linear Mixed Model with a hurdle lognormal distribution

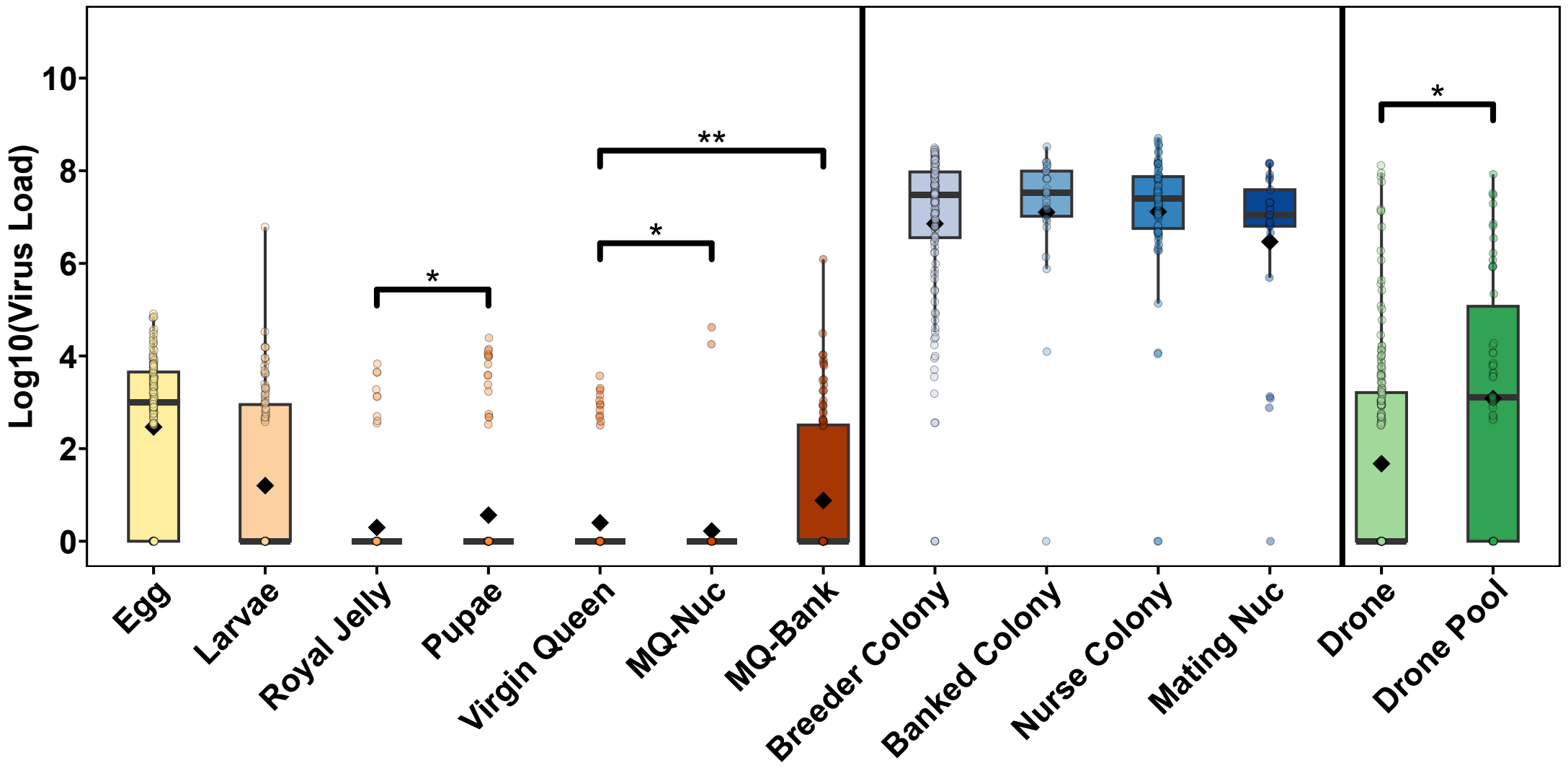
Deformed Wing Virus-A



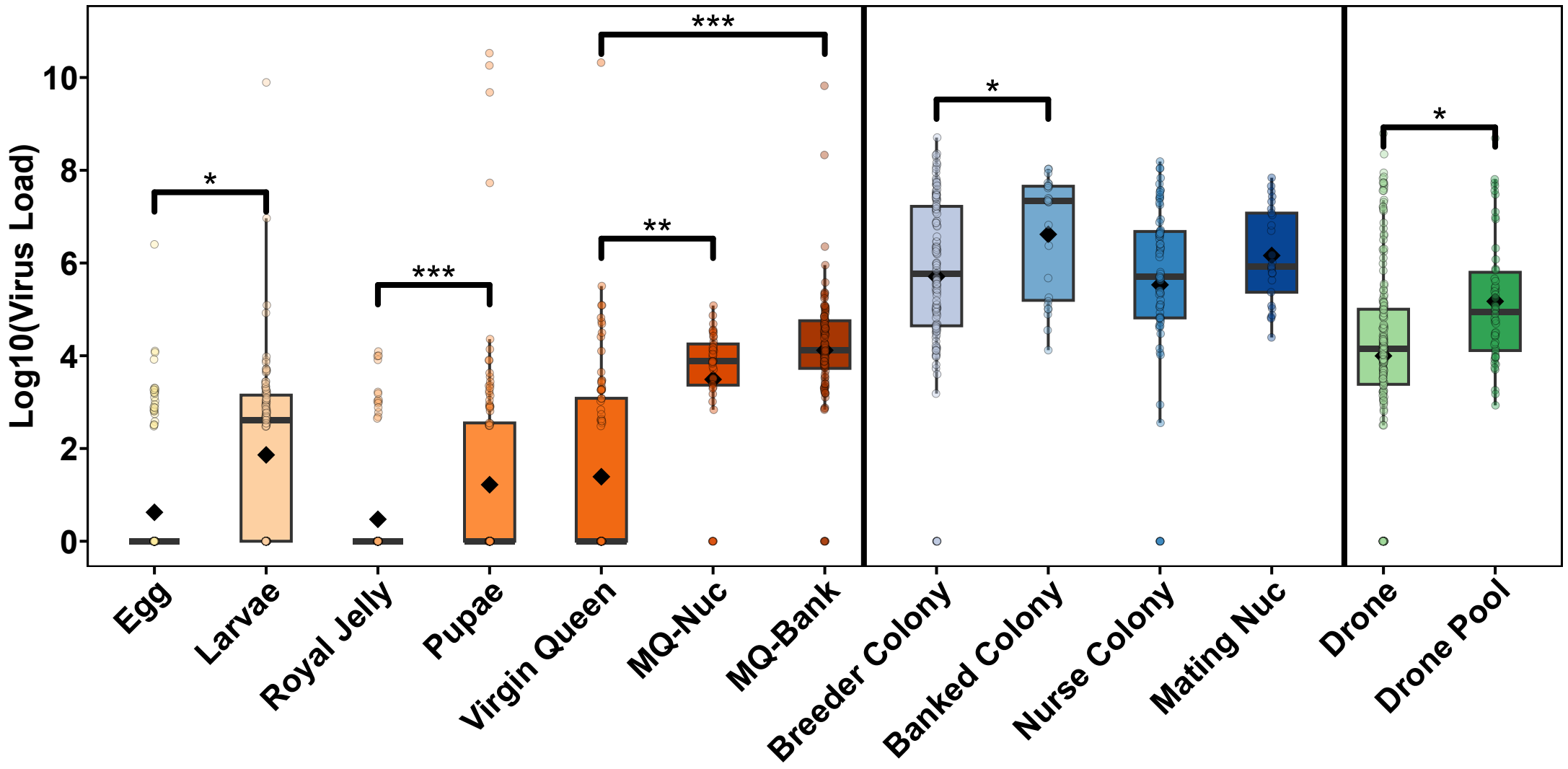
Deformed Wing Virus-B



Lake Sinai Virus

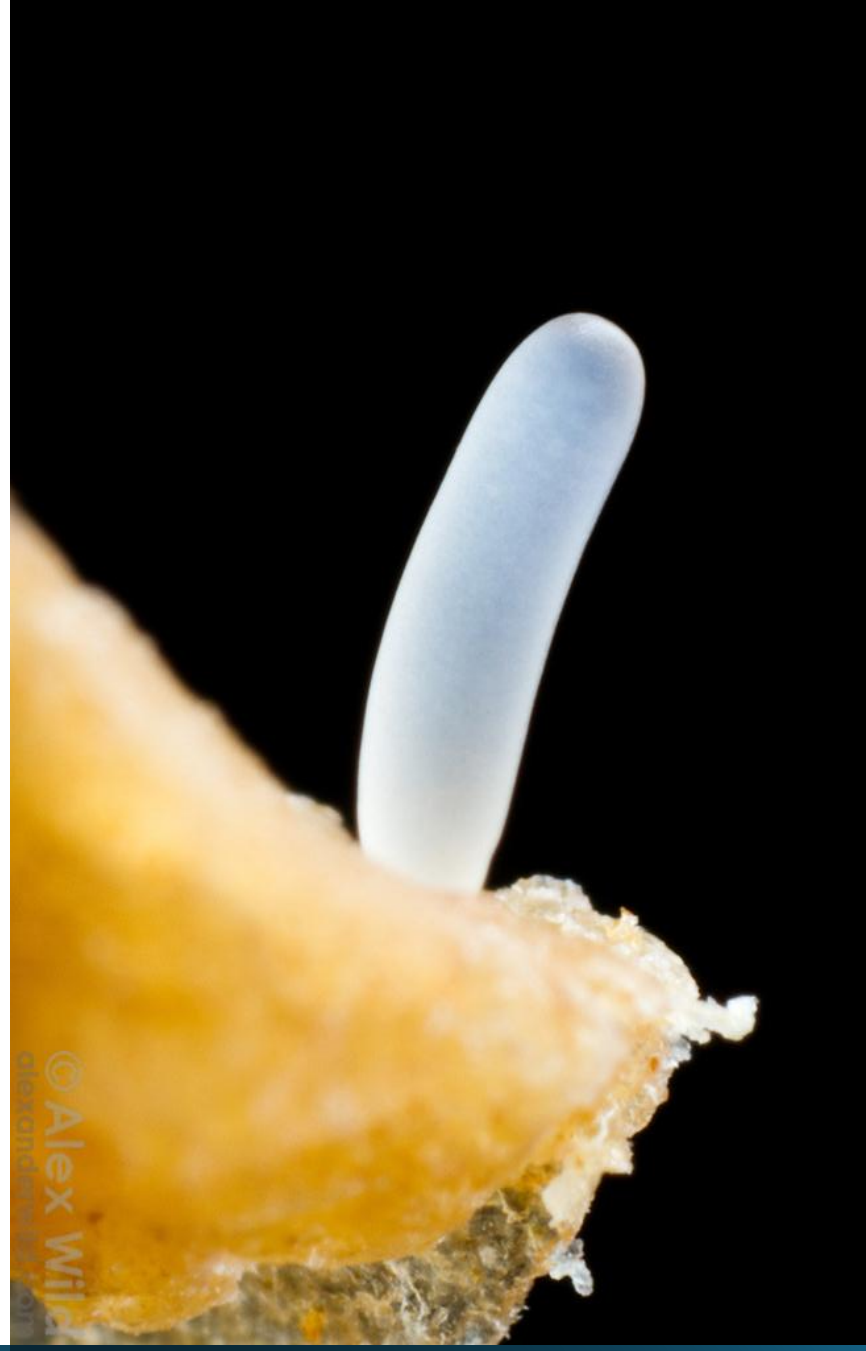


Black Queen Cell Virus



Conclusion

- Majority of breeder queens are infected, vertical transmission is common.
- Little transmission through royal jelly.
- Drones showed a high viral load.
- Queens become infected through mating.
- Queen banking can increase viral load.



Acknowledgement

Do you have any further questions?
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Project Apis m.
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& COMMERCE