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Canada



# Pathogenic Associations with Winter Colony Loss in Canada

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# Fundamental Issues in Canadian Beekeeping

- **High colony mortality**
  - Mites / Nosema / Viruses
  - Long & Harsh Winters
  - “Poor” Queens
  - Agrichemicals / Miticides



- **Heavy reliance on imported queens**
  - Volatility in Health Status  
[will sources always be there?]
  - Introducing Diseases & Invasive Genetics?
  - Mal-adapted queens ?



# How to Improve Tools and Efficiency of Selection?

*Can we use markers to select bee stocks rather than time-consuming behavioural assays?*



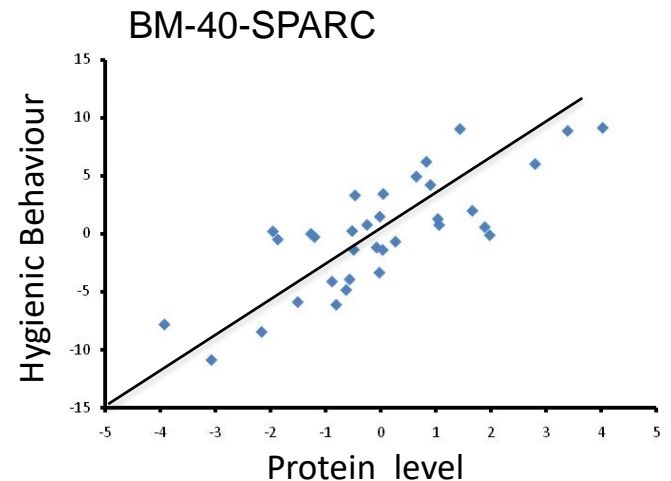
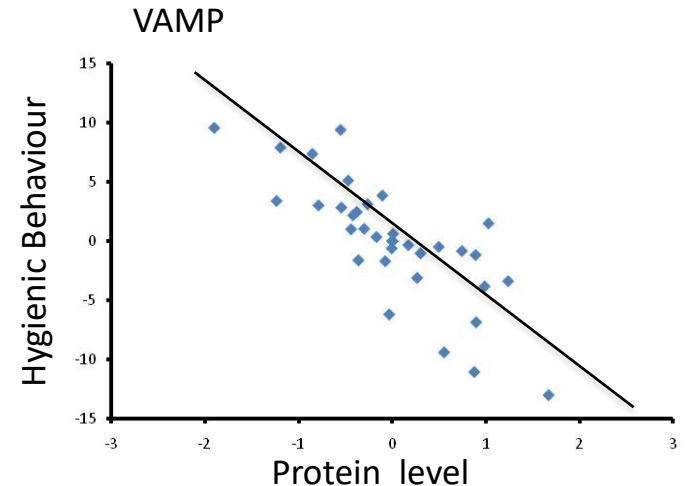


# Previous Research – Antennal Proteins as Markers

*The Identification of Potential Markers – Signal Transduction, Regulation, Ligand Binding*

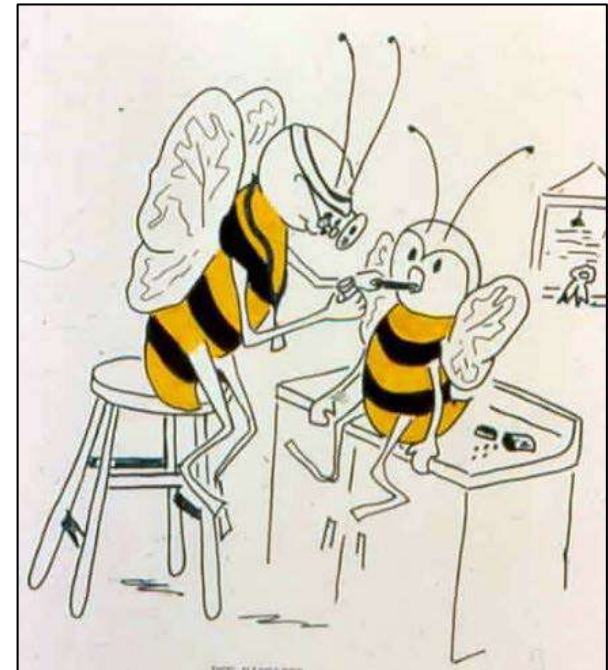


Compare *protein expression* from colonies expressing different levels of hygienic (HB) and *Varroa* sensitive hygiene (VSH) behaviour

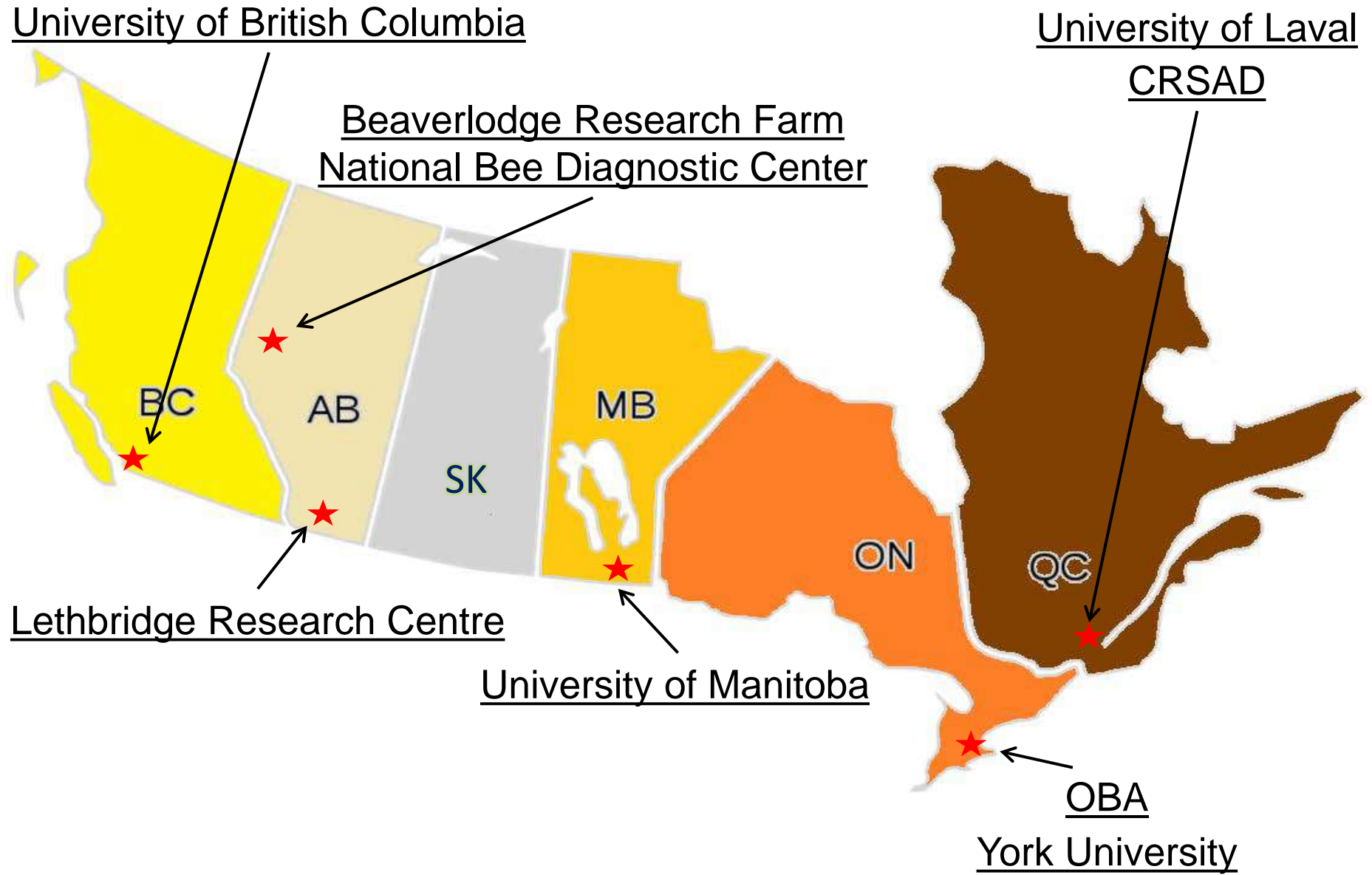


# What is BEE 'Omics about?

- Measure 12 honey bee traits
- Implement 'omic tools (proteomics and genomics) to enable beekeepers to breed healthy and productive bee colonies



# Approx. 1000 colonies monitored across Canada



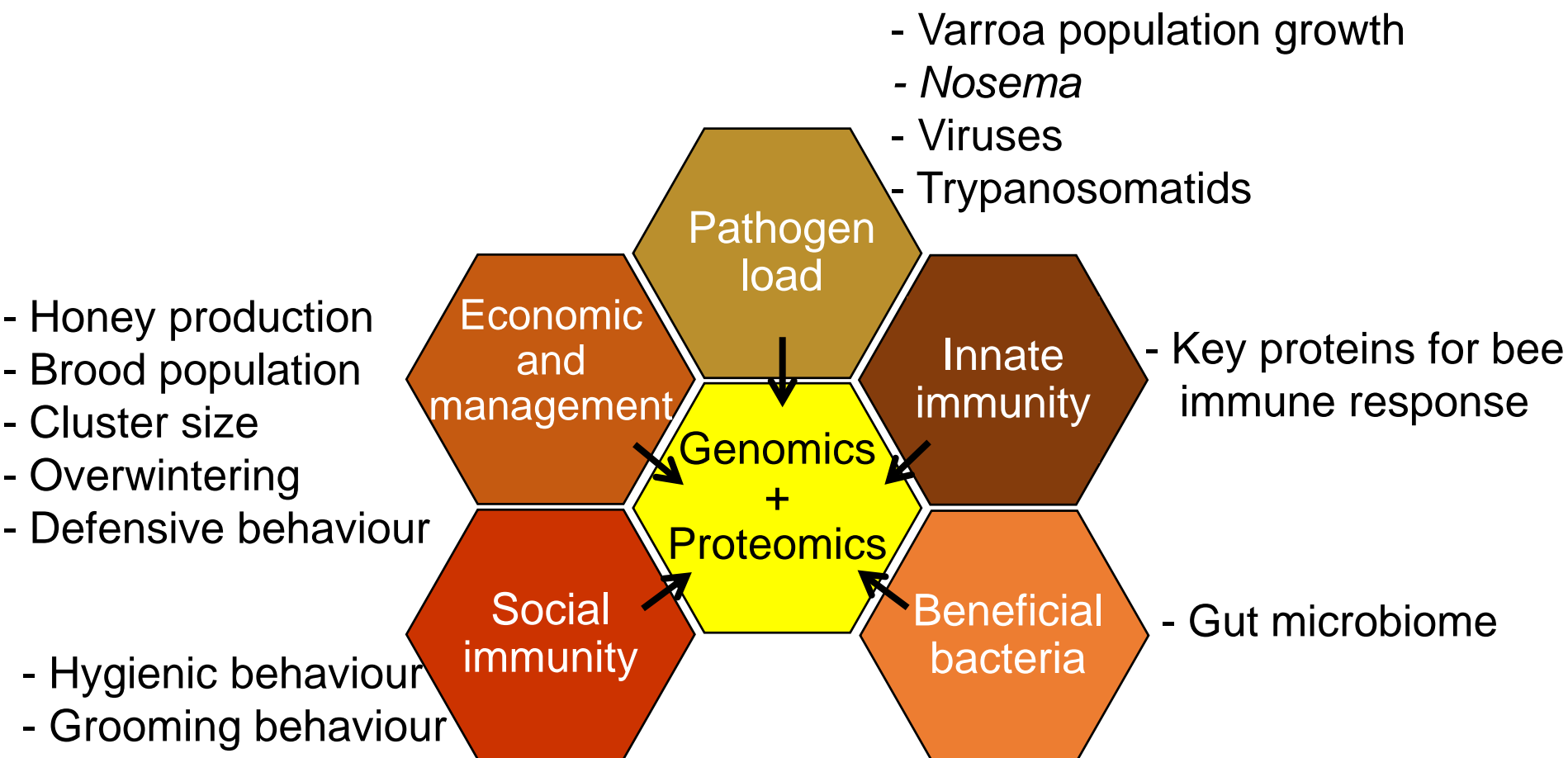






# Phenotype Evaluation

- Measuring economically-valuable traits in honey bees:





# Objectives for Phenotype Evaluation:

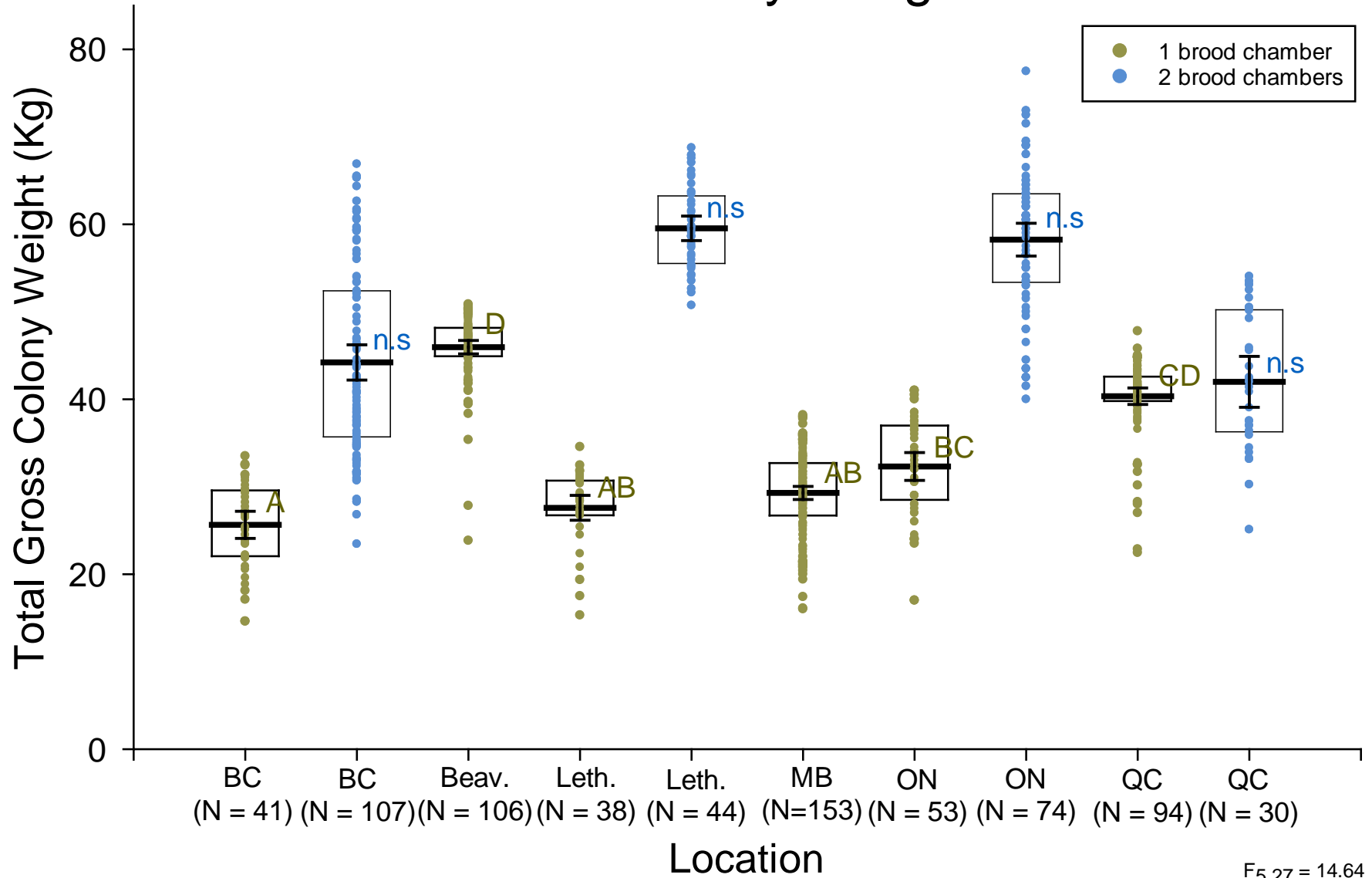


- Study *correlations* among colony phenotypes and the dynamics of pathogens and parasites on colony health and productivity.
- - See Renata Soares Borba at 10:30 a.m. in 517 on Wednesday!
- Understand the relative importance of pathogens and parasites on the *winter mortality* of colonies.

# Pre- / Post-Winter Phenotypes and Pathogens



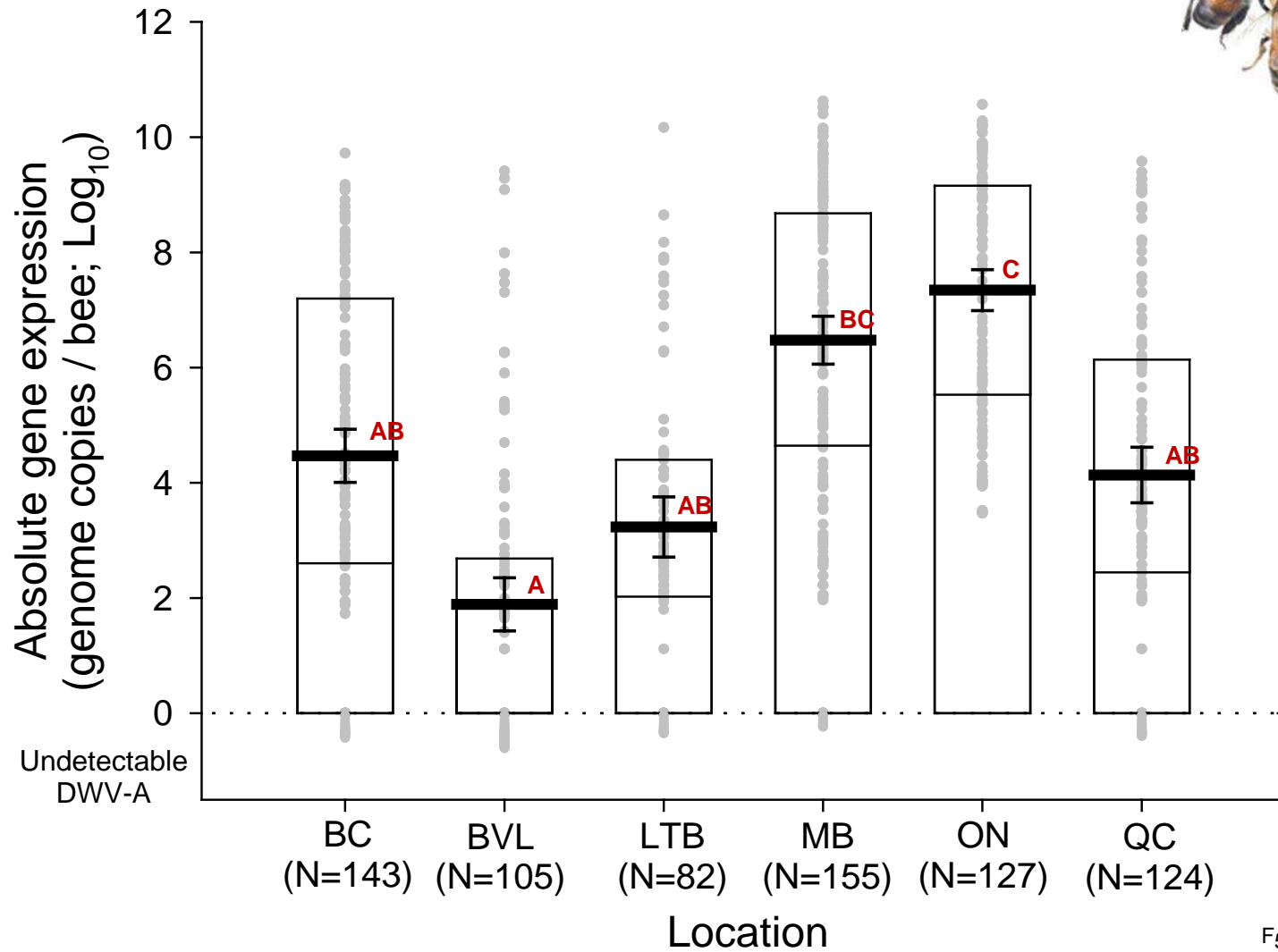
# Fall Colony Weight



$F_{5,27} = 14.64$   
 $P < 0.0001$

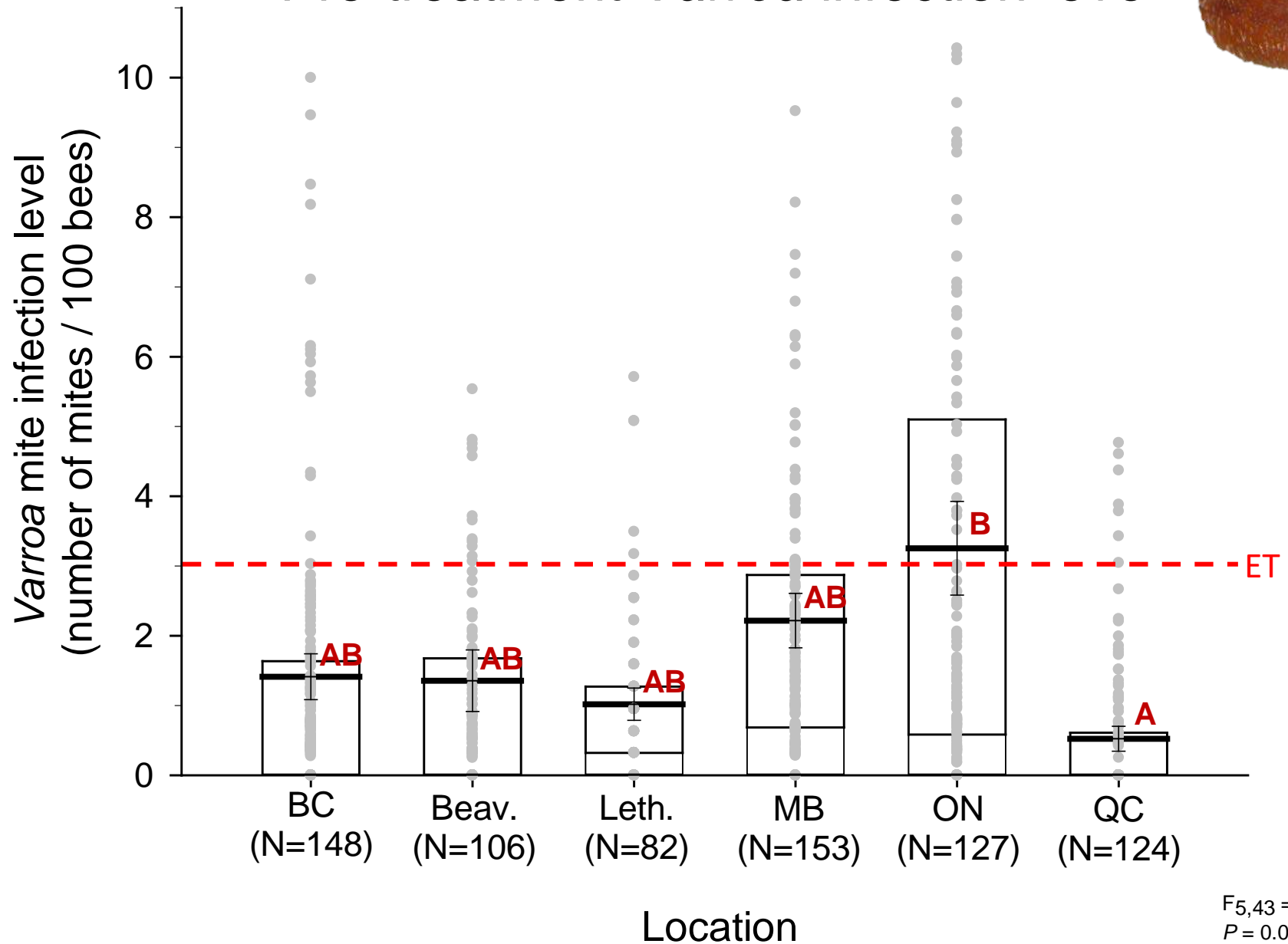


# Deformed Wing Virus - A (Fall)

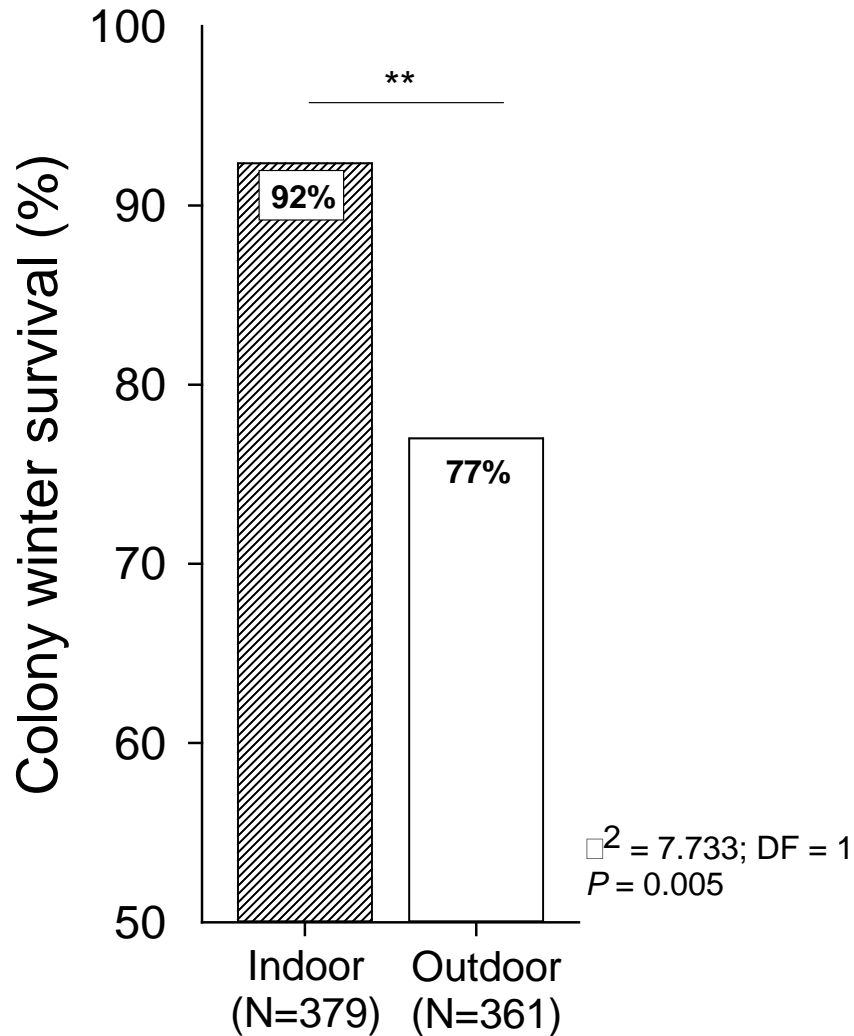


$F_{5,43} = 20.08$   
 $P < 0.0001$

# Pre-treatment *Varroa* infection level

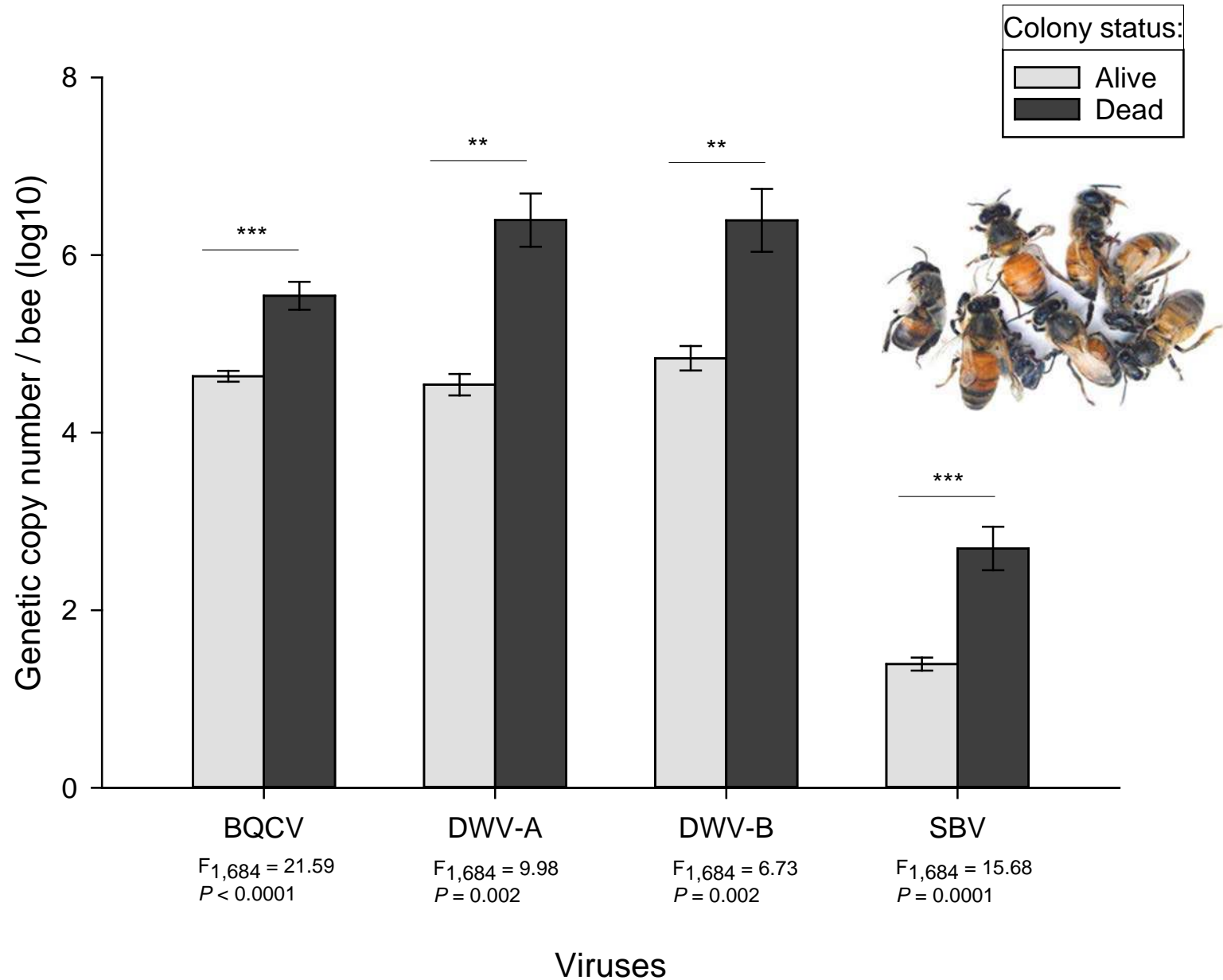


# Winter Survival

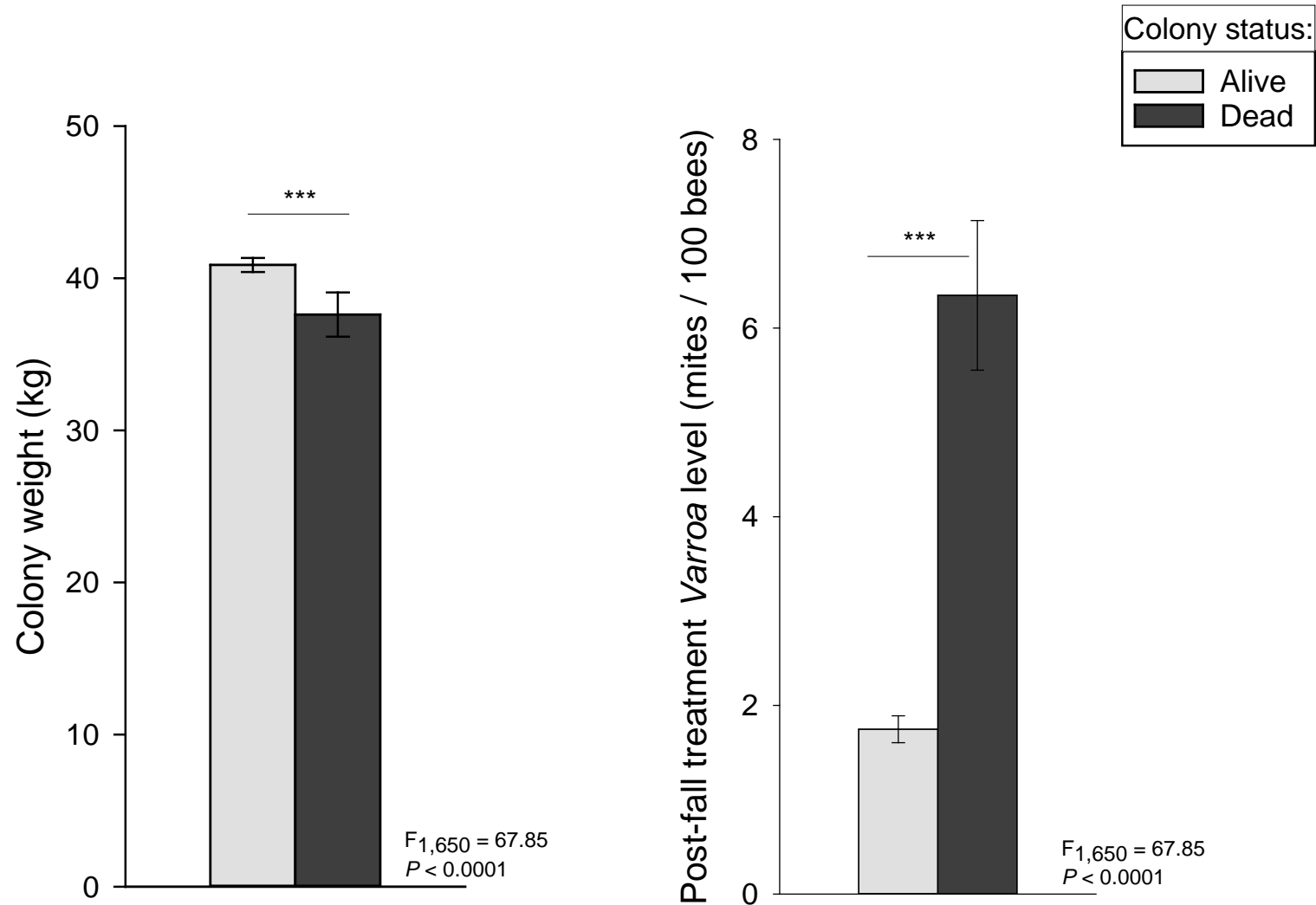




# Variation in Fall Virus Abundance and Winter Survival

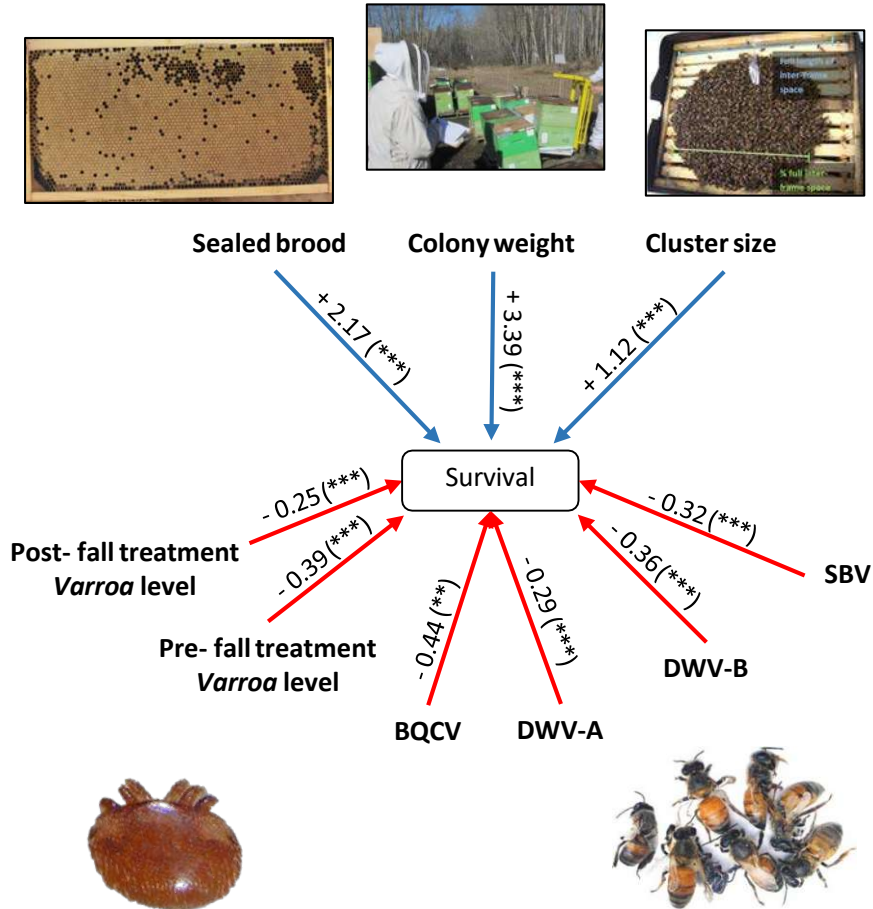


# Variation in Colony Weight / *Varroa* levels and Winter Survival

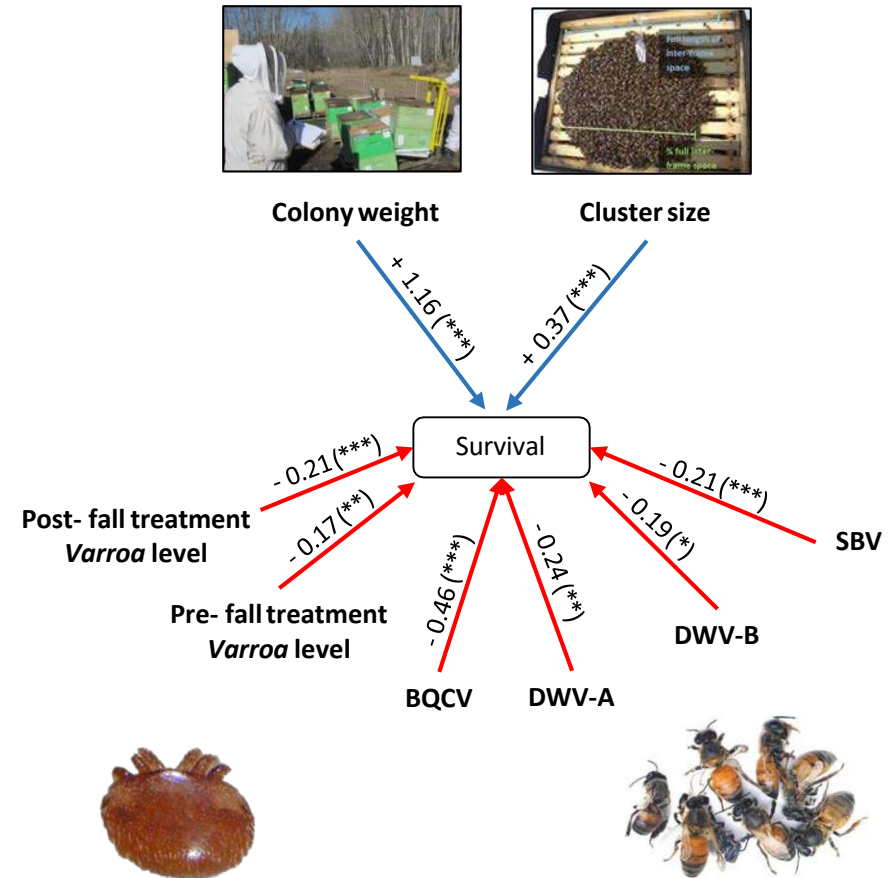


# Significant Influences on Colony Survival

Indoor



Outdoor



Significance Codes: '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05

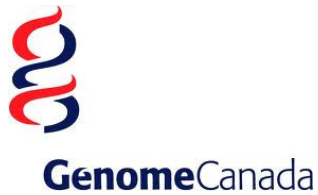


# Summary:

- Variation in fall phenotypes and pathogens among sites.
- Significant differences among phenotype and pathogen expression with surviving and dead colonies.
- Fall colony weight, brood area, Varroa and Virus loads may be predictors of winter survival.
- Risk factors similar for indoor and outdoor wintered colonies.



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