OP-141 [Bee Health]
Impact of Varroa destructor infestation on the survival, quality, and performance of honeybee queens (Apis mellifera L.) overwintered in banks

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Access to high-quality queens is crucial for the beekeeping industry, as they directly influence colony health, productivity, and survival. To enhance self-sufficiency in local queen production, the Centre de recherche en sciences animales (CRSAD) and Université Laval have been developing a mass storage technique for bee queens since 2018. However, the impact of Varroa destructor parasitism on the survival and quality of overwintered queens remains unclear. Here we show that the level of Varroa destructor infestation in autumn significantly affects the survival of overwintered queens. Queens overwintered in low-infestation banks (0-1%; LIB) had a higher survival rate (76.7 ± 17.3%) compared to those in moderately infested banks (2-5%; MIB) (69.4 ± 17.8%). In this study, we also compared the fertility, morphometric characteristics, and colony performance of queens from both infestation levels with imported queens in spring. While no significant differences were observed in morphometric traits (weight, abdomen length) or fertility (sperm count and viability) between the two overwintered groups, imported queens were, on average, 1.1 mm smaller, 25 mg lighter, and had 12% lower sperm viability than banked queens. Queen introduction success was high (94.4%) across all groups. Although imported queens initially produced more eggs in the first 10 days, overall brood development during summer was comparable between groups. However, honey production was significantly lower in colonies headed by imported queens (2.6 ± 1.3 kg) than those with LIB (12.6 ± 2.5 kg) or MIB (11.7 ± 1.8 kg) queens. Regarding pathogens, no viruses were detected in overwintered queens, whereas imported queens carried BQCV, DWV-A, and DWV-B. These findings suggest that mass overwintering of local queens is a viable alternative to queen imports. By reducing dependence on foreign suppliers, this approach minimizes the introduction of pathogens, lessens the negative impacts of long-distance transport on queen quality, and promotes local adaptations in bee populations. This approach could strengthen the self-sufficiency of the Canadian beekeeping industry while supporting sustainable colony management.

Impact of *Varroa destructor* infestation on the survival, quality, and performance of honeybee queens overwintered in banks

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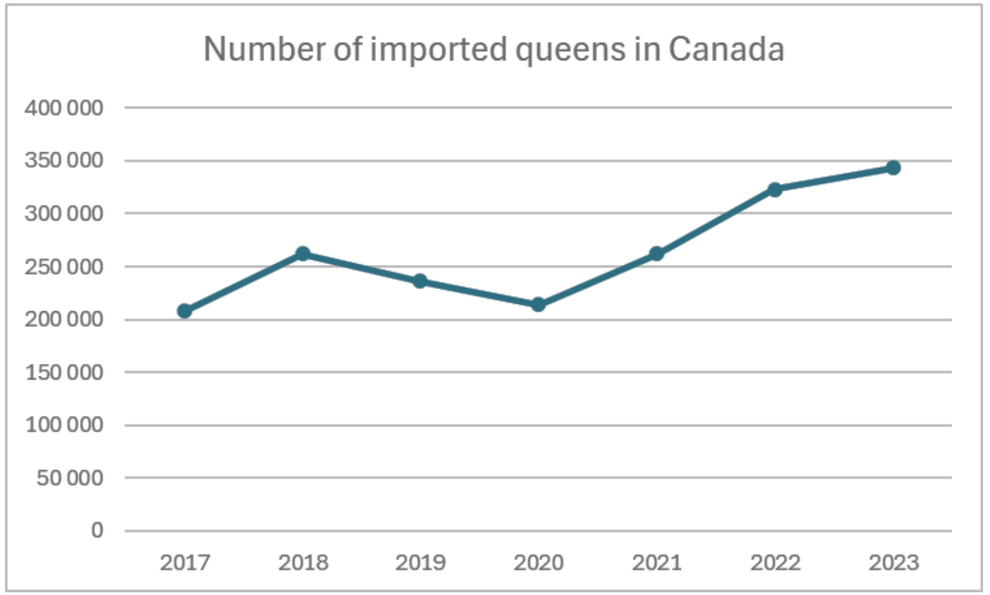
Queens supply and demand

- Peak demand of queens in early spring
- 343 125 imported queens in 2023
- 43% of canadian colonies
- 21,8M$



Statistics Canada 2024; Bixby et al. 2020; Holmes et al. 2023

Overwintering queens as a sustainable solutions to stock replacement of honeybees in early spring

- **Banking temperature : 16˚C**
- **Queen density : 40**
- **Queen's quality and performance**

agriculture

Article

Successful Indoor Mass Storage of Honeybee Queens (*Apis mellifera*) during Winter

Andrée Rousseau [1] and Pierre Giovenazzo [2,*]

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ORIGINAL RESEARCH ARTICLE

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Impacts of indoor mass storage of two densities of honey bee queens (*Apis mellifera*) during winter on queen survival, reproductive quality and colony performance

Mireille Levesque[a], Andrée Rousseau[b] and Pierre Giovenazzo[a]**

Objectives

1) Evaluate the impact of *Varroa destructor* on the survival of queens banked for 8 months.

2) Compare the impact of 2 varroa infestation levels in banks on the quality and performance of queens and compare them with imported queens

Methodology

Queen survival, fertility and morphometric measurements

- **Bank formation**

2 groups :

7 low varroa banks (0-1% varroa)

7 high varroa banks (2-5% varroa)

- **Introduction of 40 queens/bank (560 queens)**
- **2 x 16 L of 2:1 sugar syrup**
- **Apivar treatment**

September

Queen survival check
Indoor wintering at 16 ˚C

October

Queen survival check

April

Methodology

Queen quality, introduction and performance in colony

Importation of 30 foreign queens

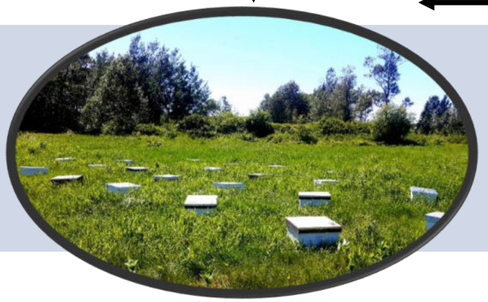
Queen fertility and morphometric measurements (N= 14 Imported queens; 14 low varroa queens and 14 high varroa queens)

- **Weight and abdomen length**
- **Sperm viability**
- **Sperm count**

36 colonies :
12 Imported queens
12 Low varroa queens
12 High varroa queens

Brood evaluation
Varroa, *Nosema* and virus

Honey production



May

June

July

August

Results

Queen survival

Queen survival during fall (August to October) and winter (October to April) for the 2 varroa infestation groups

Fall infestation level	Mean survival rate (%; ± SE)	
	Fall survival of queens August to October	Winter survival of queens October to April
0-1% (N=7)	88.5 ± 5.4a	76.7 ± 7.7a
2-5% (N=7)	90.3 ± 2.1a	69.4 ± 6.7b

Results

Queens morphometric measurements and fertility in spring

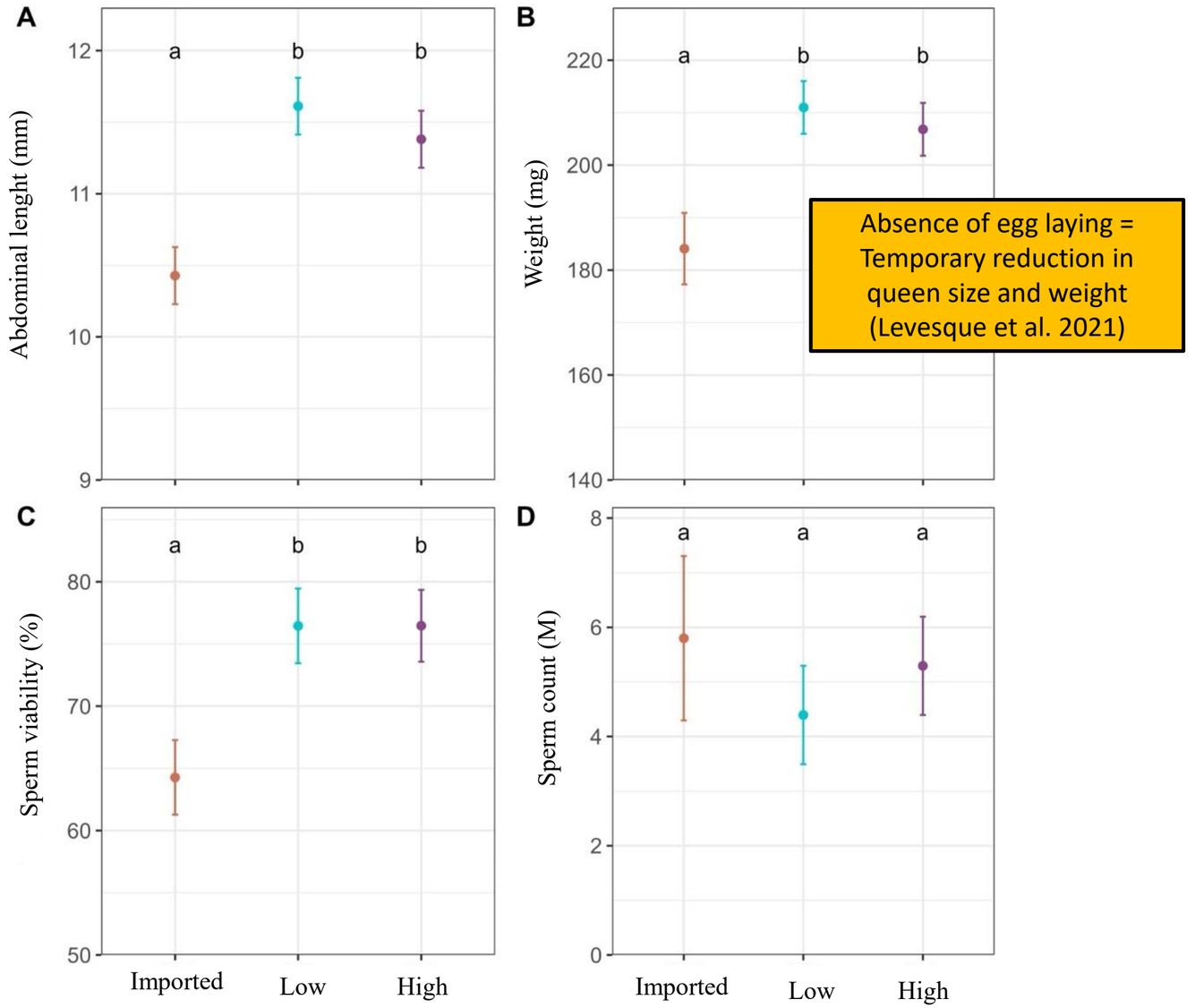


Figure 1. Queen morphometric measurements (abdomen lenght and weight) and fertility (sperm viability % and sperm count in M) in spring

Results

Performance in colony

No difference between groups for :

Introduction success 94%

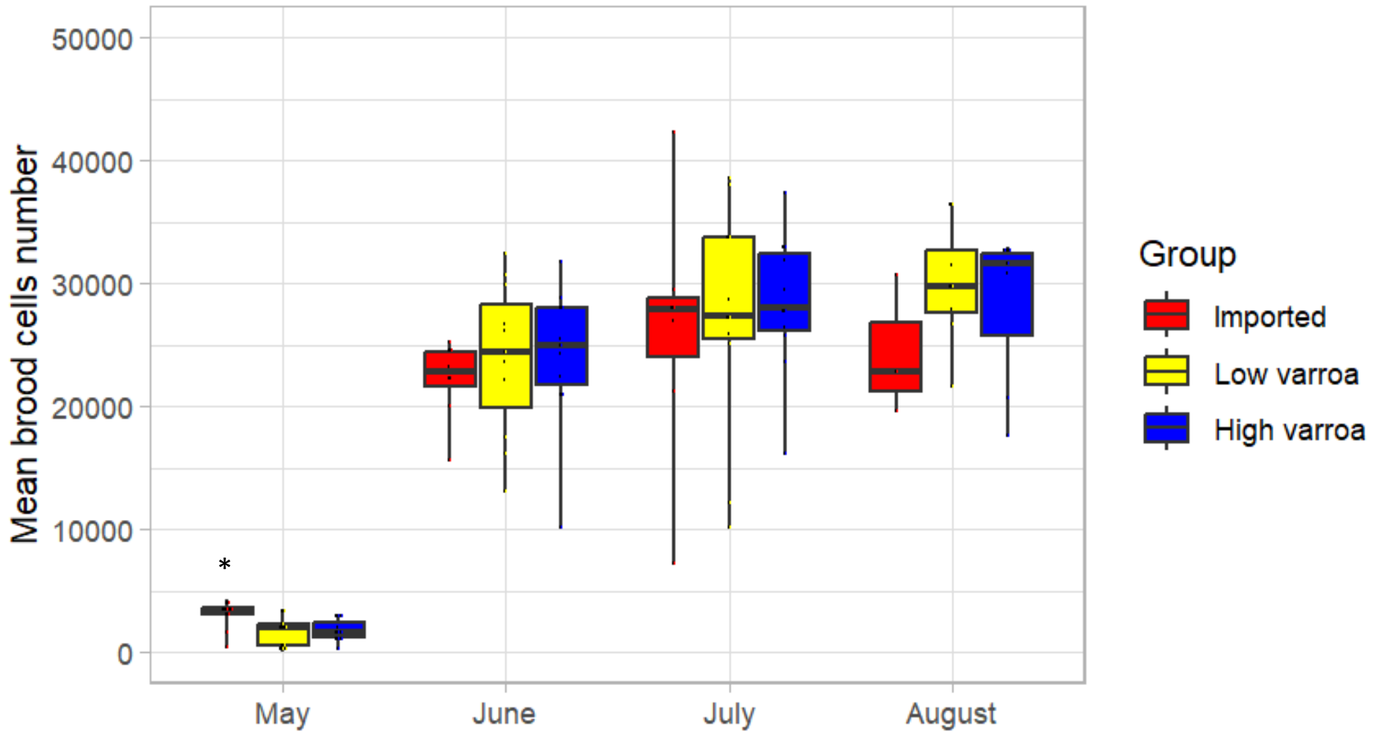


Figure 3. Mean brood cells (± SE) in May, June, July and August for the colonies with imported queens, queens from low and high varroa infestations

Results

Mean honey production :

- 2.6 ± 1.27a kg for imported queens
- 12.6 ± 2.5b kg for banked queens in low varroa banks
- 11.7 ± 1.82b kg for banked queens in high varroa banks

Conclusion

- Impact of varroa fall infestation on survival of overwintered queens :

  → **Varroa control is key to the success of banking queens overwinter**

- Differences between banked and imported queens

  → **Effect of queen's travel conditions on sperm viability?**

  → **Importance of adaptations for honey productivity**

- Great potential of the indoor overwintering technique to have access to early locally raised queens

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