

Applied research in Queen breeding



Andrée Rousseau

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CRSAD

- + 400 experimental colonies
- including 150 breeding program colonies (10-12 lines).
- Projects conducted at CRSAD:
 - BeeProbio: Sustaining honeybee health with probiotics (Université Laval, Nicolas Derome, Pierre Giovenazzo , Lallemand)
 - Evaluation of honeybee colonies by intelligent hive management plateform (Nectar)
 - Mass storage of honeybee queens during winter in Canada (Queen breeders, Université Laval, Mapaq)



Queen breeding station



- **200 mating nuclei**
- **Open mated area**
- **Instrumental insemination**



M. Bédard

Applied research in queen breeding

**Evaluation of Queen
Shipping Methods**

**Mass storage of honey
bee queens
overwintered at
different temperatures
in Canada**

Evaluation of Honeybee Queen Shipping Methods



Andrée Rousseau, Noémie Lampron, Émile Houle, Pierre Giovenazzo



Queens travel



- +200 000 queens imported to Canada in 2016 (Page 2017)

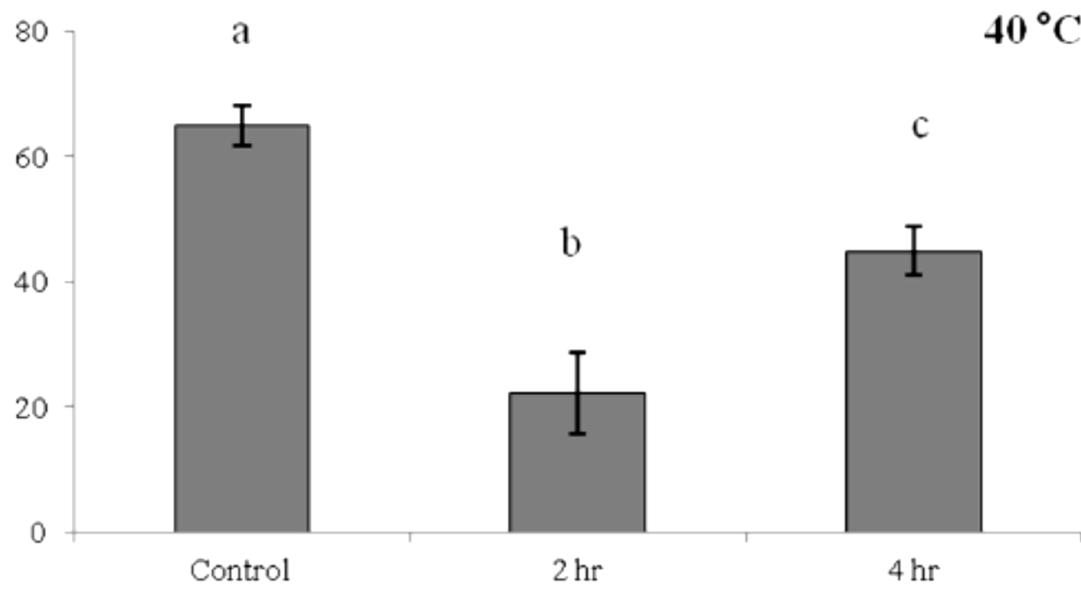


Anicet Desrochers

Queens travel



Shipping conditions are not controlled



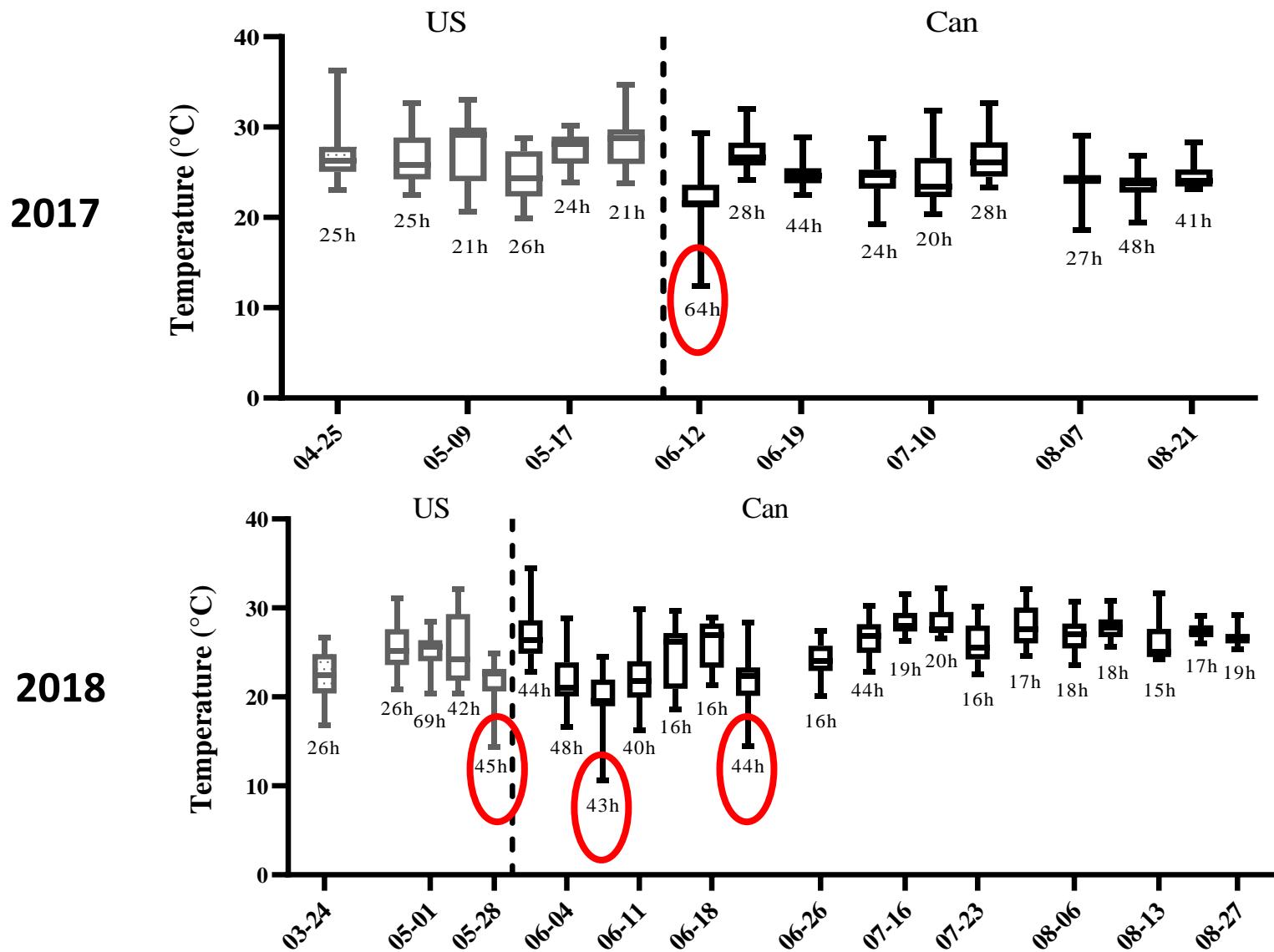
Queen temperature exposure time

Pettis et al. 2016

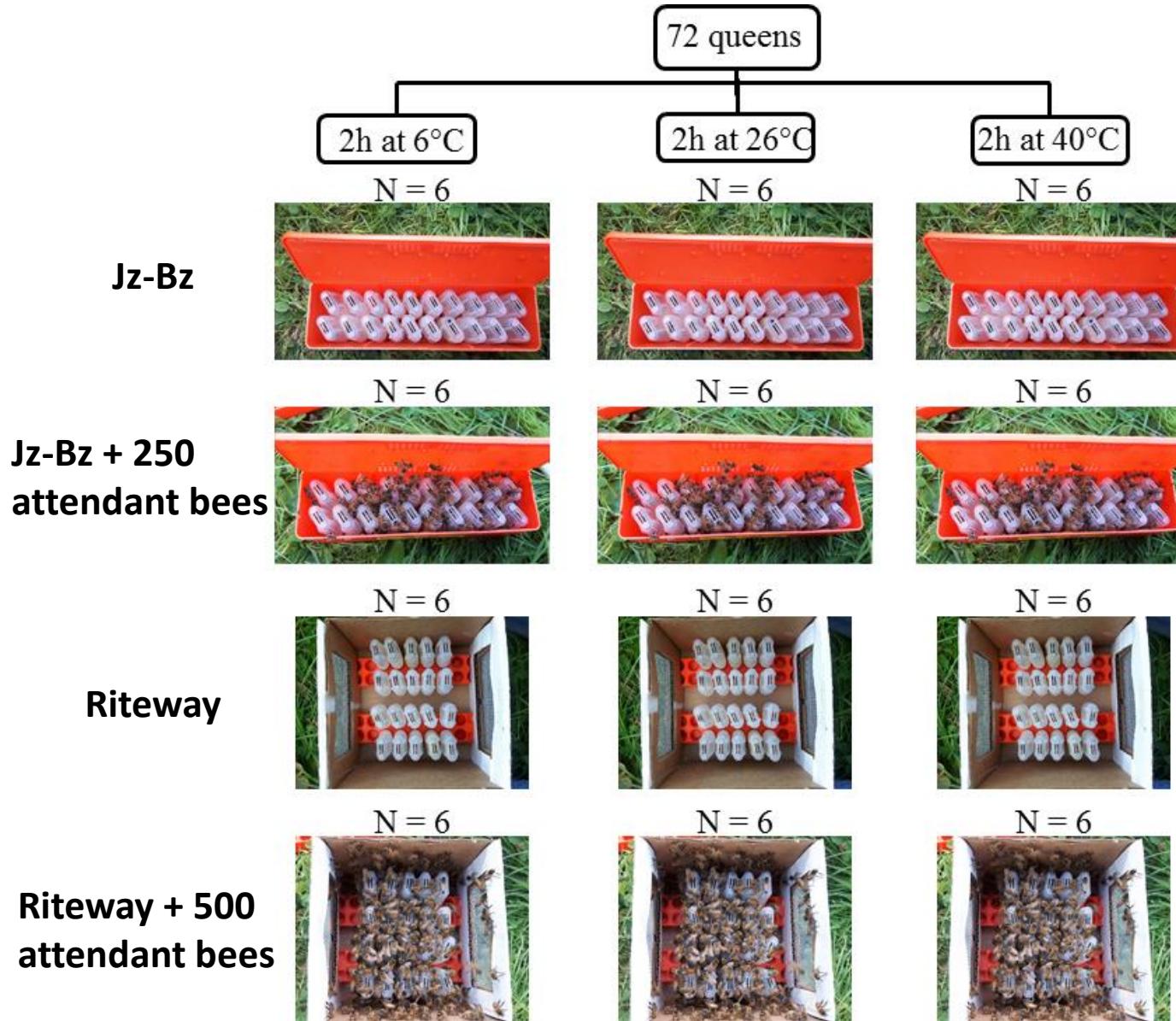
Objective

- 1- Obtain more information about queen shipping conditions in Canada
- 2- Evaluate different shipping options in terms of thermoregulation and sperm viability
- 3- Assess long-term effects of shipping methods

Queen shipping conditions



Evaluation of shipping methods



Evaluation of shipping methods



Sperm viability

- Queen dissection (N=70)

Spermatheca

1.5ml Kiev Buffer

- Fluorescence stains

Live/Dead Sperm Viability Kit

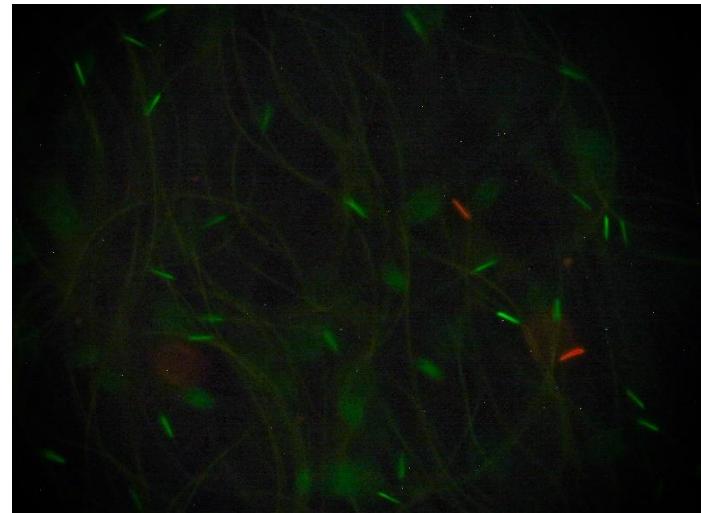
SYBR-14

Propidium iodide

4 slides of 200 sperm/queen



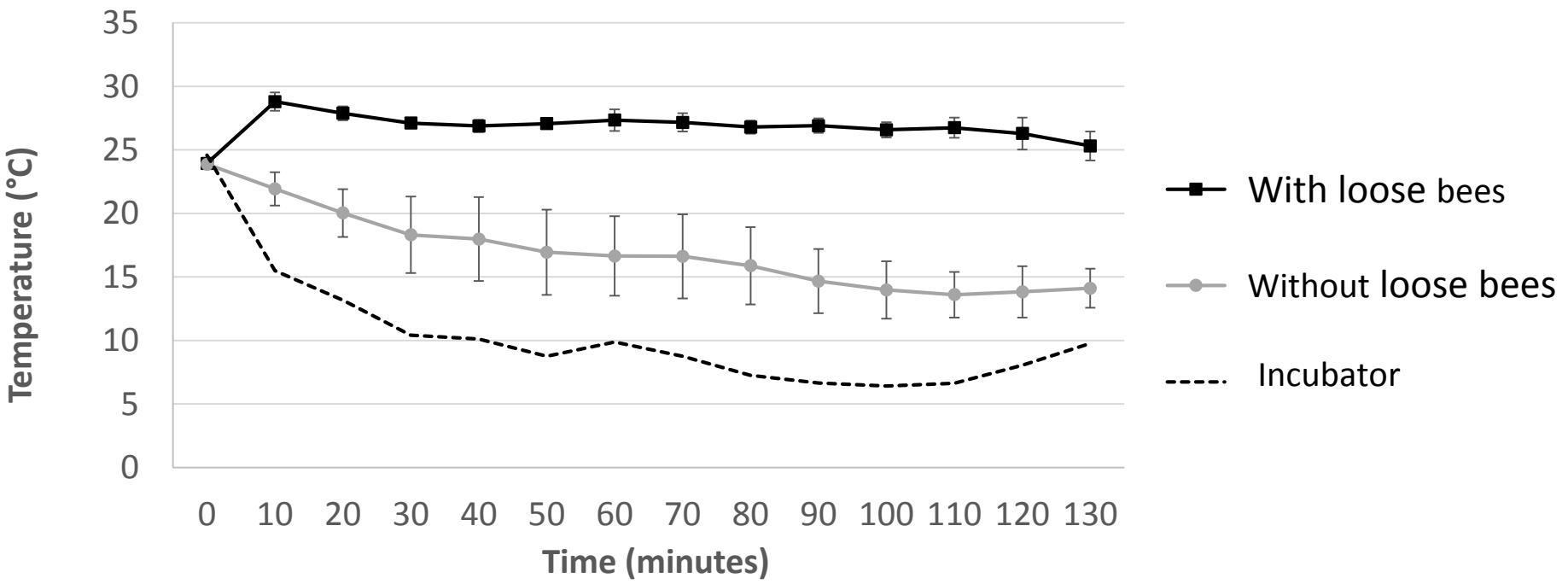
Sylvain Gingras



Thermoregulation

Effect of adding loose bees : **6°C**

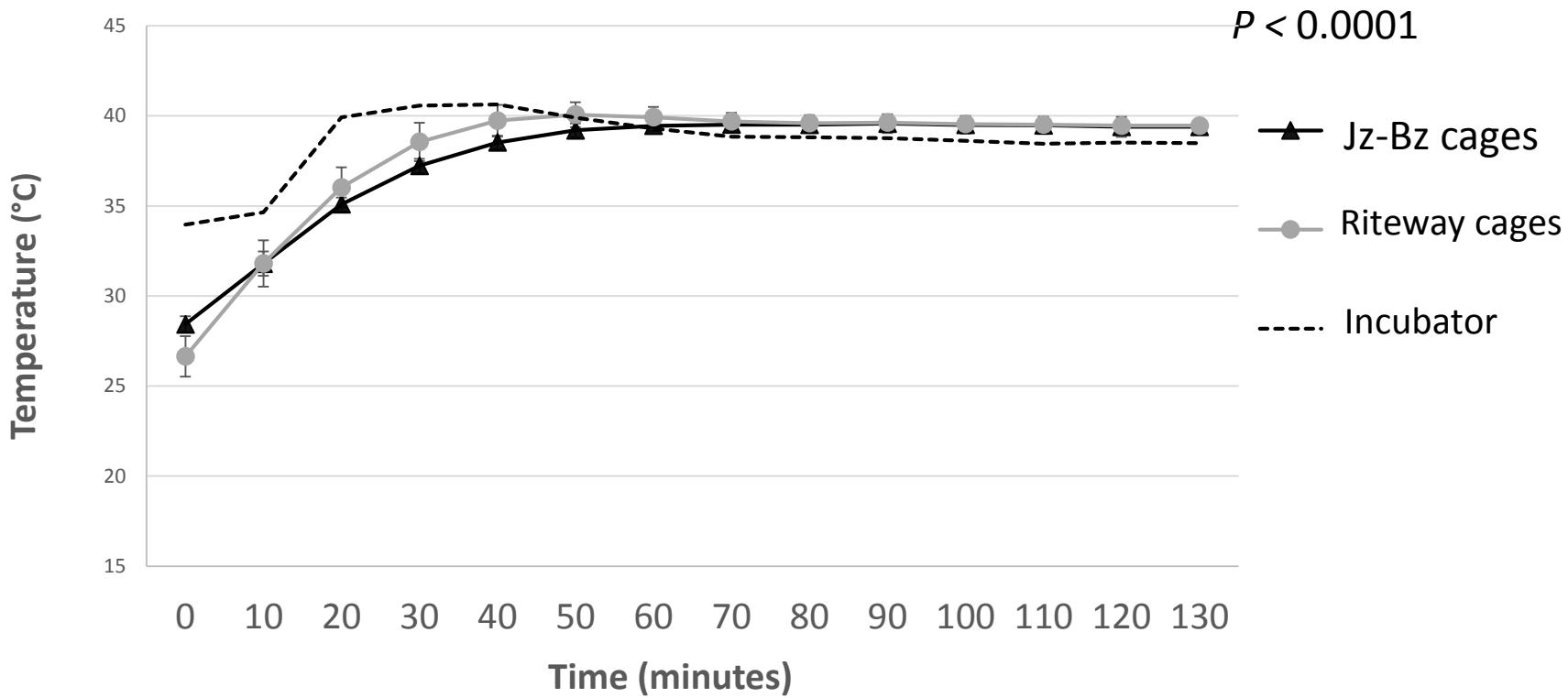
$P = 0.0001$



No cage type effect

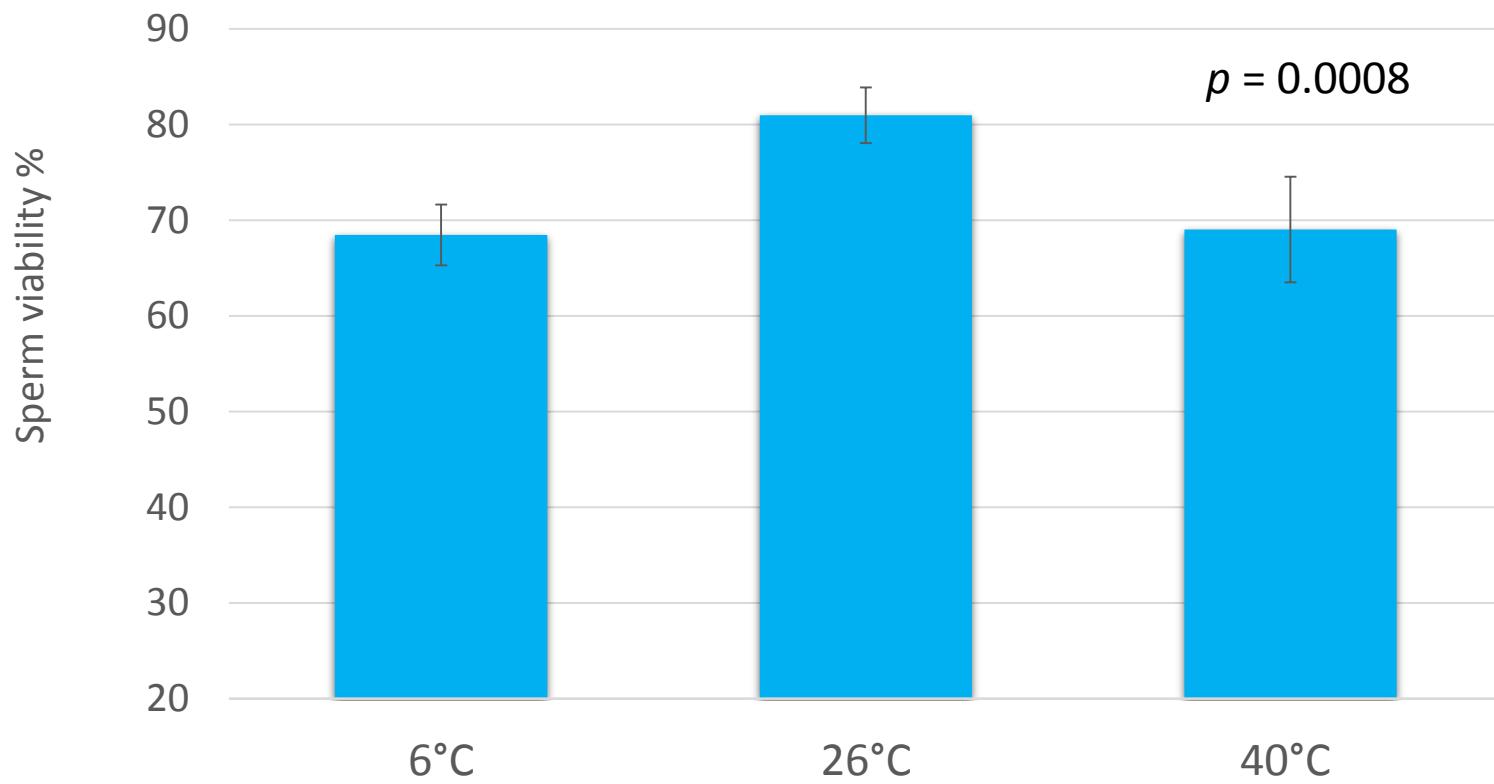
Thermoregulation

40°C



No effect of adding loose bees

Sperm viability



No effect of the shipping method

Conclusion

- Variable conditions during shipping
- Better thermoregulation with loose bees at low T
- No effect of various shipping methods on sperm viability

Future work:

- How to improve shipping conditions
- Effect on colony productivity



Mass storage of honey bee queens overwintered at different temperatures in Canada



Andrée Rousseau, Mireille Levesque, Émile Houle and Pierre Giovenazzo
Centre de recherche en sciences animales de Deschambault

Queen needs in Canada

- Queen breeding season in Canada
- Replacement of annual colony losses (25.7% colony losses in 2018)
- High demand for queens in Spring
- Dependency on foreign queens
 - Border closure possibility
 - Diseases, pathogens and genotype
 - Local adaptations

Canadian annual Queen bee imports
June 2017

Queen Bee Imports	Canada
# Q US	207,764
\$ US	\$6,788,322
# Q Other	18,216
\$ Other	\$565,719
Total Q	225,980
Total \$	\$7,354,041

Sustainable solution?

Queen banks

- Storage of a large number of queens in a single colony for few days/weeks
 - No laying queen
 - Constant renewal of young nurse bees
 - Nectar and pollen
- From September, formation of a bee cluster to minimize heat loss at less than 10-13°C (50-55°F)



<https://pollinator.cals.cornell.edu>

Storage and wintering of queens



University of Guelph 2015



Prabucki et al. 2003; Shehata 1982; Szabo 1975)

Objectives

To assess the potential of **indoor** queen overwintering systems at temperatures below and above cluster formation to maximize queen survival and quality from September to April

- 1) To develop an indoor wintering technique for a large number of queen bees over 7 months
- 2) To test the effect of the banking temperature on the survival and quality of queens

Methods

- Formation of queenless banks in September 2018
- 40 queens/bank; 15 banks (600 queens)
- T° and RH% monitored inside colonies (Onset® Data Loggers)
- 3 overwintering rooms 4°C, 10°C and 15°C (Nov. to April)
- Control group : 20 free queens within colonies at 4°C



Methods

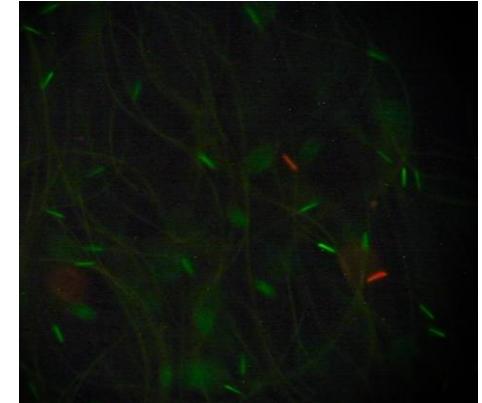
Evaluation pre storage (September 2018):

Queen's dissection

- Queen's weight and size
- Sperm viability % (Live/Dead Sperm Viability Kit))

Evaluation post storage (April 2019)

- Queen survival after 7 months of banking
- Queen's weight, size and sperm viability %



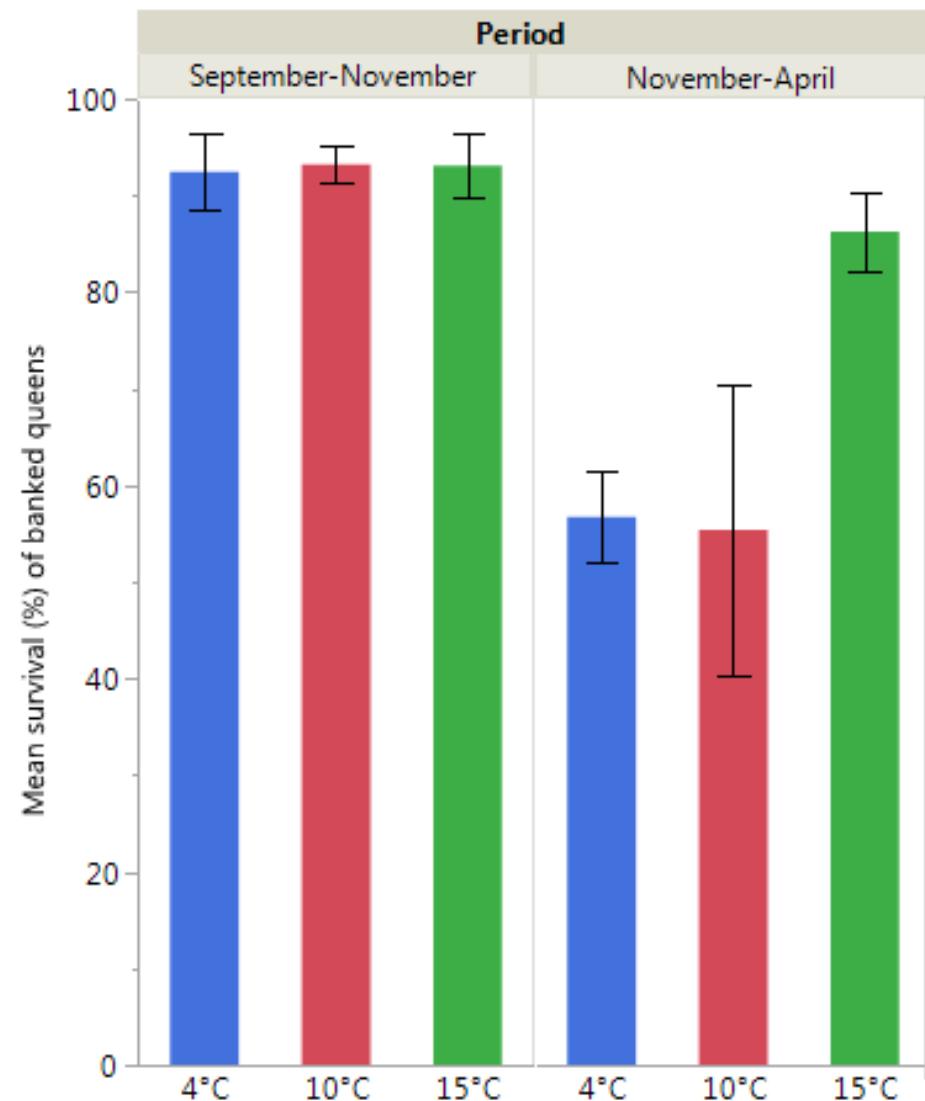
S. Gingras

Results

Queen survival

	Period	Total number of live queens	Mean number of live queens/bank	Mean survival %
Outdoor	September 2018	550	37 ± 2	
	November 2018	512	34 ± 3	Sept – Nov. 93,1%
Indoor	April 2019	337	22 ± 8	Nov. - April 65,8%

Queen survival



Group	Live queens in Nov	Live queens in April	Mean survival % from Nov to April
4	173	99	56,9%
10	172	93	55,5%
15	168	145	86,4%

Queen's quality

Group	Weight (mg)	Abdomen lenght (mm)	Abdomen width	Thorax width	Sperm viability %
Before banking (N=9)	$205,1 \pm 13,9a$	$9,43 \pm 0,67a$	$4,89 \pm 0,54$	$4,84 \pm 0,45$	$77,1 \pm 9,6$
After banking					
Control group (N=7)	$275,7 \pm 19,1b$	$12,46 \pm 0,59b$	$5,05 \pm 0,3$	$4,77 \pm 0,27$	$74,7 \pm 15,3$
4°C (N=14)	$197,3 \pm 15,0a$	$9,44 \pm 0,86a$	$4,82 \pm 0,19$	$4,82 \pm 0,23$	$84,3 \pm 3,2$
10°C (N=10)	$191,3 \pm 30,6a$	$9,35 \pm 0,98a$	$4,82 \pm 0,42$	$4,69 \pm 0,29$	$79,4 \pm 11,0$
15°C (N=15)	$197,9 \pm 20,9a$	$9,49 \pm 0,75a$	$4,86 \pm 0,21$	$4,75 \pm 0,24$	$82,7 \pm 4,6$

Different letters within a column indicate significant difference (Tukey's HSD test at level 0.05)

Next

- At 15°C: 600 queens for winter 2019-2020
- Effect of the queen's density (40 and 80) on the survival
- Effect of the queen position on the survival
- Follow up of the queens after banking :
- Queen introduction success
- Colony performance (brood pattern and development, honey production, diseases)



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Cultivons l'avenir 2
Une initiative fédérale-provinciale-territoriale

