WINTER COLONY LOSSES AND RENEWAL OF HONEY BEE LIVESTOCK IN AUSTRIA

Robert Brodschneider
Karl Crailsheim

KARL-FRANZENS-UNIVERSITÄT GRAZ
UNIVERSITY OF GRAZ
COLOSS survey on winter colony losses

Brodschneider et al., 2010; van der Zee et al., 2012
COLOSS survey on winter colony losses

Brodschneider et al., 2010; van der Zee et al., 2012
## Colony dynamics

|--------------|---------|---------|---------|---------|---------|

### Operations
- Spring 2010: 10690 colonies
- Fall 2010: 12654 colonies
- Spring 2011: 10559 colonies

### Statistical Significance
- **P > 0.05, Chi² Test**
Colony dynamics

|---------------|---------|---------|---------|---------|---------|

832 operations

Summer reproduction

Fall 2011

20841 colonies

Spring 2011

17566 colonies

P<0.05, Chi² Test

Winter loss

Spring 2012

15198 colonies
Renewal of honey bee life stock

- After a winter with very high losses
- How do beekeepers compensate for losses?
- "Market research" on honey bee trade
Material & Methods

- **COLOSS survey on winter loss**
- **Follow-up study**
  - Online (LimeSurvey 1.91)
  - 75% response, 246 answers
- **Production of livestock**
- **Buy and sell of livestock**
  - Queens, nuclei, swarms, colonies
- „Market research“: reasons; details of bee trade etc.
### Results: operation types

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Median operation size</th>
<th>Winter loss (%) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keepers</td>
<td>23</td>
<td>6.5</td>
<td>18.0 (8.7-33.6)</td>
</tr>
<tr>
<td>Breeders</td>
<td>185</td>
<td>12</td>
<td>25.0 (21.5-28.9)</td>
</tr>
<tr>
<td>Sellers</td>
<td>38</td>
<td>45</td>
<td>15.0 (10.7-20.7)</td>
</tr>
<tr>
<td>Total</td>
<td>246</td>
<td>13</td>
<td>21.0 (18.3-24.1)</td>
</tr>
<tr>
<td>Precursor study</td>
<td>1537</td>
<td>12</td>
<td>25.9 (24.6-27.2)</td>
</tr>
</tbody>
</table>

- Sellers: Reprod. & Sale
- Breeders: Reprod.
- Keepers: No reprod.
Multiplication Factor (MF)

\[ MF = \frac{\text{NewUnits} + \text{OriginalColonies}}{\text{OriginalColonies}} \]

- **Queens**: \( MF_Q \)
- **Swarms**: \( MF_{S/N} \)
- **Nuclei**: \( MF_C \)

Honey bee units

After winter

Photo: www.lvwi.de
Multiplication Factor (MF)

\[ MF = \frac{\text{NewUnits} + \text{OriginalColonies}}{\text{OriginalColonies}} \]

- Beekeeping operation 1 colony
  - 0 new colony \( \rightarrow \) MF = 1
  - 1 new colony \( \rightarrow \) MF = 2
  - ...

Photo: www.lvwi.de
Multiplication Factor (MF)

- Annual demand for honey bee livestock:
  
  - Compensation winter losses  25.9  1.371
  - Regular requeening         40.9  0.409
  - Problem related requeening  7.7   0.077
  - Other losses               ??    --

  Overall multiplication factor:  1.857
  Median operation MF:             1.667
## Results: MF

### ANNUAL DEMAND:

**Overall multiplication factor:** 1.857

<table>
<thead>
<tr>
<th>MF</th>
<th>Keepers</th>
<th>Breeders</th>
<th>Sellers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Boxplot of multiplication factor (MF) for Keepers, Breeders, Sellers, and Total](image)
Results: Reproduction

How is renewal accomplished?

<table>
<thead>
<tr>
<th></th>
<th>Queens</th>
<th>Nucs, swarms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home-grown</td>
<td>83.7%</td>
<td>97.6%</td>
</tr>
<tr>
<td>Purchased bees</td>
<td>16.3%</td>
<td>2.4%</td>
</tr>
</tbody>
</table>
Results: Reproduction

Usage of bought and home-grown honey bees

n = 802 bought bee units, 3137 home grown bee units
Results: Buying queens or bees (Market research)

- Total set: n=246 - 25% do not buy, 75% buy bees or queens
- Keepers: n=23 - 75% do not buy, 25% buy bees or queens
- Breeders: n=185 - 50% do not buy, 50% buy bees or queens
- Sellers: n=38 - 25% do not buy, 75% buy bees or queens
Results: Buying and selling

n=2247 (sell), 756 (buy)
Results: Buying and selling

- **Sell Queens**: 75% artificial inseminated, 45% unmated, 30% open mated, 0% controlled mated
- **Buy Queens**: 45% artificial inseminated, 55% unmated

- **Sell Colonies**: 15% artificial inseminated, 85% unmated
- **Buy Colonies**: 100% unmated

- **Sell Swarms, Nuclei**: 100% unmated
- **Buy Swarms, Nuclei**: 100% unmated

$n=2247$ (sell), $756$ (buy)
Results: Buying queens or bees

- Queens (n=115)
- Nucs & colonies (n=53)

Month of bee purchase:
- April
- May
- June
- July
- August
- September
Results: Buying queens or bees

46.7% of purchasers order in advance

92.5% of pre-orders were successfully executed

Month of reservation

n=88
Results: Buying queens or bees

- 51.8% purchase bees from one sales operation

- 48.2% purchase bees from more than one sales operation
Results: Buying queens or bees

- Reasons to choose sales-operation

![Bar chart showing approval percentages for various reasons]

- Quality
- Confidence
- Genetics
- Nearby
- Price
- Other
- Habit
- No alternative known

n=137
Results: Buying queens or bees

- **Spatial aspects:**

Distance between honey bee buyers and sellers in Austria in 2012 (n=153)

- Median (21.5 km)
- Average (50.1 km)
Conclusions - general

- The production of and business with honey bee livestock is an important part of beekeeping
  - This might become more important when colony losses increase
- Proposition to study not only colony losses but also compare with reproduction
  - Multiplication factor
    - Estimate annual demand
    - Estimate annual reproduction
Conclusions - Austria

- MF in Austria 2012 ~ 1.8
  - „Breeder“ operations (and total community) achieve this MF
  - Specialised „Seller“ operations exceed this MF
- Beekeepers are self-supporters
- More than 50% of operations buy honey bee livestock
  - Replace queens
  - Restore winter losses
- Bee trade is mainly a local business