Diseases and heavy metals in honeybees in the Netherlands, results of a national monitoring in June 2008

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Objective

- Prevalence in the Netherlands of
  - Viruses
  - EVB
  - AVB
  - *Acarapis woodi*
  - *Nosema apis*
  - *Nosema ceranae*
  - Heavy metals
Monitoring set up

- Random check of
  - 170 beekeepers
  - Pooled bee sample of 5 hives per apiary
Sampling

- Bees brushed off from outer frame without brood
- Age class distribution

Age classes distribution:
- 5 weeks
- 4 weeks
- 3 weeks
- 2 weeks
- 1 week

Frame percentages: 0% to 100%
Methods

- **AVB (culture)**  
  \[+ < 1\% \, (1 \, \text{op} \, 170)\]

- **DNA: (PCR)**
  - *Nosema apis*  
    \[+ : 10\% \quad -- : 90\%\]
  - *Nosema ceranae*  
    \[+ : 87\% \quad -- : 13\%\]
  - *Melissococcus pluton*  
    \[+ : 36\% \quad -- : 64\%\]
  - *Ascosphaera apis*  
    \[+ : 43\% \quad -- : 57\%\]
  - *Aspergillus flavus*  
    \[+ : 0\% \quad -- : 100\%\]
  - *Acarapis*  
    \[+ : 5\% \quad -- : 95\%\]

- **RNA (PCR): viruses:**
  - KBV, DWV, BQCV, SBV, CBPV, ABPV, IV, IAPV
viruses in NL honeybee colonies

<table>
<thead>
<tr>
<th>VIRUS</th>
<th>positive %</th>
<th>negative %</th>
<th># samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kashmir Bee Virus</td>
<td>0</td>
<td>100</td>
<td>170</td>
</tr>
<tr>
<td>Deformed Wing Virus (Varroa)</td>
<td>16</td>
<td>84</td>
<td>170</td>
</tr>
<tr>
<td>Black Queen cell virus (Nosema)</td>
<td>92</td>
<td>8</td>
<td>170</td>
</tr>
<tr>
<td>Sac brood virus (Varroa)</td>
<td>40</td>
<td>60</td>
<td>170</td>
</tr>
<tr>
<td>Chronic bee paralysis virus</td>
<td>0</td>
<td>100</td>
<td>170</td>
</tr>
<tr>
<td>Acute bee paralysis virus (Varroa)</td>
<td>0</td>
<td>100</td>
<td>170</td>
</tr>
<tr>
<td>Iridescent virus</td>
<td>0</td>
<td>100</td>
<td>170</td>
</tr>
<tr>
<td>Israeli acute paralysis virus</td>
<td>0</td>
<td>100</td>
<td>170</td>
</tr>
</tbody>
</table>
Results

- **American Foulbrood**
  - < 1% (1 out of 170) (culture)
    - 300 000 spores / bee (pooled sample of 5 colonies), clinical symptoms in the diseased apiary.
  - Honey (culture of 190 honey sample from samples apiaries)
    - 3% (<10 – 100 spores / gram honey)

- **Little prevalence of AFB because of**
  - Prevalent mixed bee races in the Netherlands?
  - Prevalent Dutch beekeepers practice: making artificial swarms, resulting in a brood less period of each colony?
Nosema apis

10% positive
Most in the North
Pushed away by Nosema ceranae?
Nosema ceranae

87% positive
Prevalent Nosema infection
N. apis / N. ceranae

- neg / neg: infrequent
- neg / pos: prevalent *N. ceranae*
- pos / neg: very infrequent
- pos / pos: infrequent
EFB

36%
Widely spread
Serious increasing problem
Acarapis

5%
Remarkable given the frequent use of miticides / varroacontrol
Not considered as major problem
Black Queen Cell Virus
- green: negative
- red: positive

BQCV

92%
Prevalent virus infection
BQCV / N. ceranae

Neg / neg: infrequent
Neg / pos: infrequent
Pos / neg: infrequent
Pos / pos: prevalent combination
Summary results bee diseases

- AFB infrequent occurrence in the Netherlands
- EFB prevalent (increase last decennia)
- *Nosema apis* pushed aside by *Nosema ceranae* (lasting situation?)
- *Nosema ceranae* prevalent Nosema infection (lasting situation?)
- BQCV prevalent virus
- DWV and SBV prevalent but less compared to BQCV
- KBV, CBPV, ABPV, IV and IAPV not detected
Heavy metals

- Origin heavy metals in / on bees
  - Feed (pollen and nectar)
  - Atmospheric deposition particulate matter (anthropogenic)
  - Possible in-hive contamination (wood preservative, metal strips)
Methods

- ICP-AES analyses
- µg g⁻¹ bee (dm)
- pooled sample of 25 bees from outer frame
- 19 metals (Al, As, Ba, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Sb, Se, Sn, Sr, Ti, V, Zn)
Zinc

Emissions
- batteries
- plastics
- rubber production
- paints
- lubricants
- pesticides

Topsoil conc. ≥ 84 ppm
(Veer 2006)
Cadmium

- Batteries
- Plastics

North Sea

Topsoil conc. ≥ 0.36 ppm

(Veer 2006)
Cupper

Emissions

- electrical industry
- water piping
- pigments
- bactericide
- fungicide
- insecticide

Topsoil conc ≥ 17 ppm
(Veer 2006)
Selenium

Emissions

- glass manufacturing
- galvanizing
- semi-conductors
- pigments
- agriculture

Topsoil conc. ≥ 1 ppm
(Veer 2006)
Heavy metals

Results
- Metals detectable in significant different amounts in/on bees
- Significant different amounts between regions and within a region
- No significant link to topsoil / subsoil contamination
- Environmental memory period: 2 weeks

Interpretation
- Signal function
  - Detection heavy metals on bees >> food sources and rest of ground surface
- Atmospheric deposition of PM containing heavy metals is plausible
Thank you for your attention