Heritability and repeatability of insect bite hypersensitivity in Dutch Shetland breeding mares

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Introduction – IBH

Insect bite hypersensitivity (IBH)

- Chronic, recurrent, seasonal dermatitis
- Allergic reaction: intense itch
  - Cause: bites certain *Culicoides* spp.
- Clinical signs
  - Summer months
- Affected areas

*affected base of tail and hindquarters, affected mane and shoulder*
Introduction – IBH

- Discomfort and disfiguration
  - Welfare reduced
  - Unsuitable for riding/showing
  - Commercial value reduced
- No effective treatment or prevention

- Multifactorial etiology
- Heritability estimates (0.08 - 0.36)
  - Small populations
  - Only Icelandic horses
- Repeatability estimates
Introduction – aim

Estimate heritability and repeatability of insect bite hypersensitivity in Dutch Shetland breeding mares
Materials and methods – data collection

- Dutch Shetland breeding mares
- During foal inspections at home
- 16 inspectors

Score clinical signs of IBH
- Visual observation
- Score: 0, 1, 2
- Scores 1 and 2 grouped together
- Binary
Materials and methods – data

- 7,924 IBH scores
- 6,073 mares
  - 26% repeated observations
- Mares descended from
  - 984 sires
  - 4,455 dams
    - 34% ≥1 IBH score

Percentage of mares with 1, 2 or 3 IBH scores:
- 1 score: 74%
- 2 scores: 21%
- 3 scores: 5%

Mare A with foal
Mare A is dam of mare B

Mare B with foal
Materials and methods – data

- **Age:** 8.1 yr (SD = 4.1)
- **Withers height categories (WHC)**
  - 29% Mini (≤ 86 cm)
  - 22% Small (87 through 92 cm)
  - 24% Middle (93 through 98 cm)
  - 25% Tall (99 through 107 cm)
Materials and methods – model

- Linear repeatability animal model:

\[ \text{IBH score} = \mu + \text{yearmonth} + \text{climate} + \text{habitat} + \text{WHC} + \text{age} + \text{animal} + \text{pe} + \text{e} \]

Map of the Netherlands expressing the annual number of warm days
(van Grevenhof et al., 2007)
Results and discussion – IBH prevalence

- Prevalence

![IBH prevalence chart]

<table>
<thead>
<tr>
<th>Year of scoring</th>
<th>IBH prevalence mares, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>8.6</td>
</tr>
<tr>
<td>2005</td>
<td>9.6</td>
</tr>
<tr>
<td>2006</td>
<td>8.4</td>
</tr>
</tbody>
</table>
Results and discussion – IBH prevalence

- Prevalence

- Prevalence mares descending from
  - Affected dams (n = 93)
  - Unaffected dams (n = 1,376)
Results and discussion – IBH prevalence

- Prevalence

- Prevalence mares descending from
  - Affected dams (n = 93)
  - Unaffected dams (n = 1,376)

- Prevalence paternal half-sib groups (n = 106)
  - 0 – 37%
Results and discussion – heritability

- Literature Icelandic horses
- Hard to compare due to differences in:
  - Observed prevalence
  - Breed
  - Analysis method
  - IBH scoring

<table>
<thead>
<tr>
<th>Research</th>
<th>$h^2_{obs}$ (SE)</th>
<th>$h^2_{und}$ (SE$_{und}$)</th>
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</thead>
<tbody>
<tr>
<td>Our research</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0/1</td>
<td>0.08 (0.02)</td>
<td>0.24 (0.06)</td>
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<tr>
<td>Lange (2004)</td>
<td></td>
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<tr>
<td>0/1</td>
<td>0.36 (0.08)</td>
<td>0.65</td>
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<tr>
<td>Detailed score</td>
<td>0.34 (0.09)</td>
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<tr>
<td>Eriksson et al. (2008)</td>
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<td></td>
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<tr>
<td>0/1</td>
<td>0.08</td>
<td>0.27 (0.17)</td>
</tr>
<tr>
<td>0/1/2</td>
<td>0.09</td>
<td>0.30 (0.19)</td>
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<tr>
<td>0/1/2/3</td>
<td>0.10</td>
<td>0.33 (0.19)</td>
</tr>
</tbody>
</table>
Results and discussion – repeatability

- Repeatability lower than expected
  - IBH is considered to be permanent

- Due to:
  - Fluctuations in environmental factors
  - Changing environments caused by sale
  - Intervention by owners
  - Inspectors scored inconsistent?

### Presence and activity of *Culicoides* species

<table>
<thead>
<tr>
<th>Clinical signs first observation</th>
<th>Clinical signs second observation</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Absent</td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>94.8 (1,374)</td>
<td>100 (1,450)</td>
</tr>
<tr>
<td>Present</td>
<td>72.8 (75)</td>
<td>100 (103)</td>
</tr>
<tr>
<td></td>
<td>Present</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.2 (76)</td>
<td></td>
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<tr>
<td></td>
<td>27.2 (28)</td>
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</tbody>
</table>

Repeatability

\[
\rho \ (SE) \quad 0.30 \ (0.02)
\]
Conclusions and implications

- Heritable trait
- Selection against IBH possible
- Selection
  - Decrease economic losses
  - Increase animal welfare
- Bottlenecks selection Shetland ponies
Selection against insect bite hypersensitivity is possible!
## Contact information

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
<th>Address</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
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Reference list


