Genetic parameters for *Fasciola hepatica* in Irish dairy cows

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Fasciola Hepatica (Liver Fluke)

- Parasitic disease in cattle and sheep
- Life cycle
- Environment
  - Grazing
  - Temperate climate
- Large prevalence
- Anthelmintic treatment
Why am I the only cow with liver fluke
Born in February 2009

4th lactation

Calved in April 2014

All slaughtered on 16/02/2015
Materials & Methods
Live F. hepatica

Photo courtesy of Animal Health Ireland
Liver damage caused by *F. hepatica* without live *F. hepatica*

Photo courtesy of Animal Health Ireland
No liver damage

Photo courtesy of Animal Health Ireland
Exposure

Live *F. hepatica*

Herd-mates 100 days prior diagnosis

No live *F. hepatica*

Herd-mates 100 days prior diagnosis

Born within 100 days of the diagnosed cow’s birthdate
Study Herd Data

- 69 dairy farms
- Binary trait
  - $\text{ODR} \geq 0.4 / \text{ODR} < 0.4$
- Exposed animals:
  - Herds with $> 5$ positive cows and $\geq 5\%$ prevalence
  - 48 herds exposed
Statistical Analysis

\[ Y = X\beta + Z\gamma + \varepsilon \]

- *F. hepatica*-liver damage (n=16,734)
- binary trait for antibody response (n=6,907)
Statistical Analysis

\[ Y = X\beta + Z\gamma + \varepsilon \]

- *F. hepatica*-liver damage
- binary trait for antibody response
  - HYS (herd-year-season of calving)
  - heterosis
  - recombination loss
  - age relative to parity median
  - parity
  - stage of lactation
  - factory-date (abattoir data only)
Statistical Analysis

\[ Y = X\beta + Z\gamma + \varepsilon \]

- *F. hepatica*-liver damage
- binary trait for antibody response
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  - age relative to parity median
  - parity
  - stage of lactation
  - factory-date (abattoir data only)
    - direct additive genetic effects
    - residual
Prevalence of *F. hepatica* of sire’s daughters

Number of sires

Daughter prevalence

Prevalence of ≥30 daughters ≥10 herds

N=86
Prevalence of *F. hepatica* of sire’s daughters

≥ 20 daughters
≥ 8 herds
N=52
## Results

<table>
<thead>
<tr>
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<th>Abattoir data</th>
<th>Study herd data</th>
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<tbody>
<tr>
<td><strong>Prevalence</strong></td>
<td>47%</td>
<td>37%</td>
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<tr>
<td><strong>Heritability</strong></td>
<td>0.03 (0.01)</td>
<td>0.09 (0.02)</td>
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<td><strong>Genetic standard deviation</strong></td>
<td>0.069</td>
<td>0.112</td>
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Genetic correlation between the two datasets was 0.37 (SE=0.283)
True Heritability

(Bishop and Woolliams, 2010)
(Bishop and Woolliams, 2010)
Conclusion

• Control *F. hepatica* by breeding
• Complementary to anthelmintic treatment
• Sustainable – permanent and cumulative
• Large amount of data available
Acknowledgements

Funding from the Irish Department of Agriculture, Food, and the Marine STIMULUS research grants HEALTHYGENES and FLUKELESS is greatly appreciated.