Genomic Evaluation for Clinical Mastitis in Czech Holstein

L. ZAVADILOVÁ, E. KAŠNÁ, J. KUČERA AND J. BAUER

SUPPORTED BY THE MINISTRY OF AGRICULTURE OF THE CZECH REPUBLIC
MZE-RO0718 QK1810253.
OBJECTIVES

Genomic breeding values for Clinical Mastitis (CM) by Multi-trait linear model

- Udder health traits
- Udder exterior traits
The Diary of Diseases and Medication

- The national cattle health monitoring system
- Online health recording form
- Simplified key of diagnoses based on the ICAR recommendations

Records of clinical mastitis (CM)

- Collected by farmers
- Voluntarily registered in the Diary
Prerequisite of genomic evaluation for disease resistance

- **The Diary of Diseases and Medication**
  - **2014-2017, started in 2017**
  - *Institute of Animal Science*
  - *Czech Moravian Breeders' Corporation*
  - *Veterinary Research Institute*

- **Genotyping**
  - *Holstein Cattle Breeders Association of the Czech Republic.*
<table>
<thead>
<tr>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>79,431 phenotyped Holstein cows</td>
</tr>
<tr>
<td>132,614 lactations</td>
</tr>
<tr>
<td>CM lactation incidence 19.91 %</td>
</tr>
<tr>
<td>Cows calved between 2017 and 2021</td>
</tr>
<tr>
<td>104 herds</td>
</tr>
<tr>
<td>Pedigree involved 208,217 animals.</td>
</tr>
</tbody>
</table>
Udder health traits
- Clinical mastitis (CM)
- Somatic cell score (SCS)

Effects
- Herd year season of calving
- Age parity of calving
- PE
- Animal

Udder exterior
- Udder depth
- Udder width
- Suspensory ligament
- Udder subjective score in %

Effects
- Herd year season of scoring
- Classifier
- Regression on Age and on DIM
- Animal

TRAITS
MODEL EQUATIONS
### Genomic Information

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genotyped animals</td>
<td>35,472 animals</td>
</tr>
<tr>
<td>Bulls</td>
<td>5,377</td>
</tr>
<tr>
<td>Young Bulls</td>
<td>573</td>
</tr>
<tr>
<td>Bulls with daughters with phenotype</td>
<td>1,595</td>
</tr>
<tr>
<td>Cows</td>
<td>14,941</td>
</tr>
<tr>
<td>Cows with phenotype</td>
<td>8,370</td>
</tr>
<tr>
<td>Heifers</td>
<td>15,154</td>
</tr>
</tbody>
</table>

Computed by BLUPF90 family of programs

Ignacy Misztal et al.
Heritability

Genetic correlation

<table>
<thead>
<tr>
<th>Trait</th>
<th>Heritability</th>
<th>Genetic correlations with clinical mastitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Udder</td>
<td>0.22</td>
<td>-0.30</td>
</tr>
<tr>
<td>Udder depth</td>
<td>0.38</td>
<td>-0.41</td>
</tr>
<tr>
<td>Suspensory ligament</td>
<td>0.19</td>
<td>-0.30</td>
</tr>
<tr>
<td>Udder width</td>
<td>0.16</td>
<td>0.37</td>
</tr>
<tr>
<td>Somatic cell score</td>
<td>0.11</td>
<td>0.93</td>
</tr>
<tr>
<td>Clinical Mastitis</td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>

SUPPORTED BY THE MINISTRY OF AGRICULTURE OF THE CZECH REPUBLIC MZE-R0071B QK1810253.
Genetic trends for clinical mastitis

- **Multi-trait Cows**
- **Multi-trait Bulls**
- **Single-trait Cows**
- **Single-trait Bulls**
- **No. of Cows**
- **No. of Bulls**

**YEARS OF BIRTH**

- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020
- 2021

**YEARS**

- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020
- 2021

**RELATIVE GENOMIC BREEDING VALUES IN %**

- 95
- 96
- 97
- 98
- 99
- 100
- 101
- 102
- 103
- 104
- 105

**NO. OF ANIMALS**

- 0
- 2000
- 4000
- 6000
- 8000
- 10000
- 12000
- 14000
- 16000
- 18000
Average reliability

Genomic Bulls
Genomic Bulls with Phenotyped Daughters
Young Genomic Bulls
Genomic Cows with Phenotype
Genomic Heifers
Cows with phenotype

Single-trait conventional
Multi-trait conventional
Single-trait genomic
Multi-trait genomic
Increase in reliability

- Genomic Bulls
- Genomic Bulls with Phenotyped Daughters
- Young Genomic Bulls
- Genomic Cows with Phenotype
- Genomic Heifers
- Cows with phenotype

- Multi vs. single trait model, conventional
- Multi vs. single trait model, genomic
Conclusions

- High reliability of breeding values due to multi-trait model
- Multi-trait model can be employed for increasing clinical mastitis resistance in Czech Holstein cattle
- Genomic evaluation by single-step method is suitable for health traits in Czech Holstein cattle
THANK YOU FOR ATTENTION

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