Genetic evaluation for calving ease in Croatian Simmental breed

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Introduction

- An important functional trait in dairy cattle
- … included in genetic evaluation of dairy cattle in Croatia → **genetic parameters needed**!!!

- Aim: Estimate genetic parameters for
  - **direct** additive genetic
  - **maternal** additive genetic
- Croatian Simmental breed

Material

- Central database of Croatian Agricultural Agency
- 399,344 calving ease records (after editing!)
  - 1 = no problem ~20%,
  - 2 = slight problem ~78%
  - 3 = cow needed assistance ~2%
  - 4 = veterinary assistance <1%
  - 1st and 2nd+ parities
- Animal pedigree
  - 3 generations
  - 551,368 animals

Method (1)

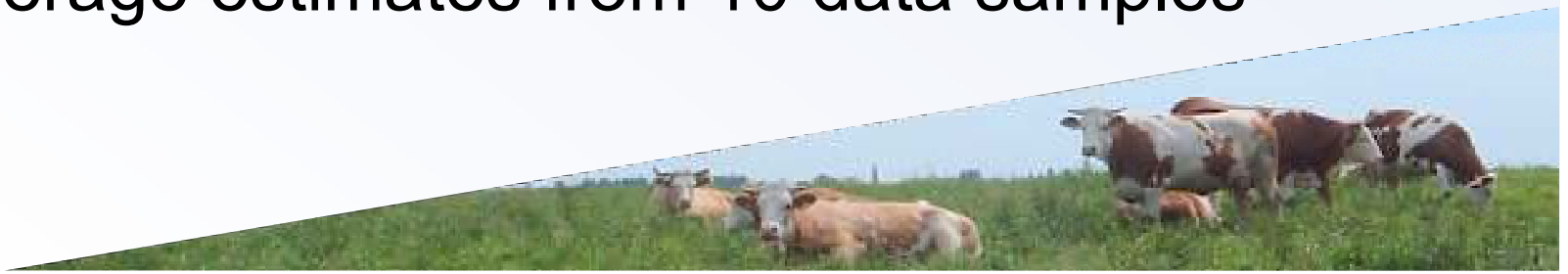
- Discrete trait! → threshold model
- … however "standard" Gaussian model was used :)

- Bivariate animal model (1st and 2nd+ parities)
  - **Fixed effects:**
    - sex*age(*parity), calving season, region*year
  - **Random effects:**
    - herd*year, direct and maternal genetic, and permanent environment (only for 2nd+)

Method (2)

- To partially account for discrete trait properties:
  - harmonization of scores by region and recording period
  - heterogeneous residual variances by sex of a calf → 4 residual variances (sex within parity class)

- Method REML in VCE-6
  - average estimates from 10 data samples



Results

Results – variance components

- Bivariate model - heterogeneous residual variances
  - herd*year: $\sigma^2_{hy_1}, \sigma^2_{hy_2}, \sigma_{hy_1,hy_2}$
  - direct & maternal genetic:

$$\left[\begin{array}{cc|c|cc} \sigma^2_{d_1} & \sigma^2_{d_2} & \sigma_{d_1,d_2} & \sigma_{d_1,m_1} & \sigma_{d_1,m_2} \\ \hline \sigma^2_{m_1} & \sigma^2_{m_2} & \sigma_{m_1,m_2} & \sigma_{d_2,m_1} & \sigma_{d_2,m_2} \end{array}\right].$$

  - permanent environment: σ^2_{pe}
  - residual: $\sigma^2_{e_{1m}}, \sigma^2_{e_{1f}}, \sigma^2_{e_{2m}}, \sigma^2_{e_{2f}}$

Results – residual variances*

- By sex of calf within parity class

	1st	2nd+	Average
Male	0.126	0.071	0.099
Female	0.071	0.059	0.065
Average	0.099	0.065	/

larger mean (1st, males) → larger variance

*SE~0.005

Results – percentages* and correlations

	HY	Direct (=h^2)	Maternal	Perm.
1st	19.8 (17.1, 23.7)	5.9 (5.1, 7.0)	6.3 (5.4, 7.5)	/
2nd+	19.8 (18.8, 20.8)	7.4 (7.1, 7.8)	9.9 (9.4, 10.5)	2.4 (2.2, 2.5)
Corr.	0.720	**0.894**	0.823	/

*average (males, females)

Results – direct-maternal

covariances $\pm$ SE

$$\begin{pmatrix} \sigma_{d_1,m_1} & \sigma_{d_1,m_2} \\ \sigma_{d_2,m_1} & \sigma_{d_2,m_2} \end{pmatrix} = \begin{pmatrix} -0.003 \pm 0.002 & -0.004 \pm 0.001 \\ -0.003 \pm 0.001 & -0.004 \pm 0.001 \end{pmatrix}$$

correlations

$$\begin{pmatrix} \rho_{d_1,m_1} & \rho_{d_1,m_2} \\ \rho_{d_2,m_1} & \rho_{d_2,m_2} \end{pmatrix} = \begin{pmatrix} -0.314 & -0.383 \\ -0.360 & -0.475 \end{pmatrix}$$

Conclusions and future work

- Variance components were estimated for calving ease in Simmental cattle in Croatia
- **Gaussian model**
- **harmonized calving ease scores**
- **heterogeneous residual variances**

- Comparison with **threshold model** is on the way