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Development of breeding values for mastitis derived from SCS results

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Motivation

- Udder health in Germany:
  - Breeding value on SCS
  - As relative EBV, RZS, 7% in total merit index (RZG)
  - Also important auxiliary trait of functional longevity
  - → real total weight of SCS in RZG is higher than 7%
  - SCS is an indirect trait to consider mastitis

Motivation

- Use of SCS as measure for mastitis:
  - ‚There is more useful information in SCS distributions than currently used in practice‘ (J. ten Napel, 2009)
  - Uninfected mammary gland has a low SCS
  - Mastitis influences the distribution of SCS
  - Several countries use SCS – test day results for the prediction of clinical and subclinical mastitis

Motivation

- Use of SCS as measure for mastitis:
  - Heritabilities for mastitis are low (in general for health traits)
  - Estimates between 4% and 8% (Heringstadt, 2000 and 2008, Madsen et al., 2008, Govignon-Gion et al., Miglior et al., 2012)
  - Genetic correlations to SCS between .50 and .80 (see above)
  - Modified SCS-results are widely used to estimate mastitis → alternative traits

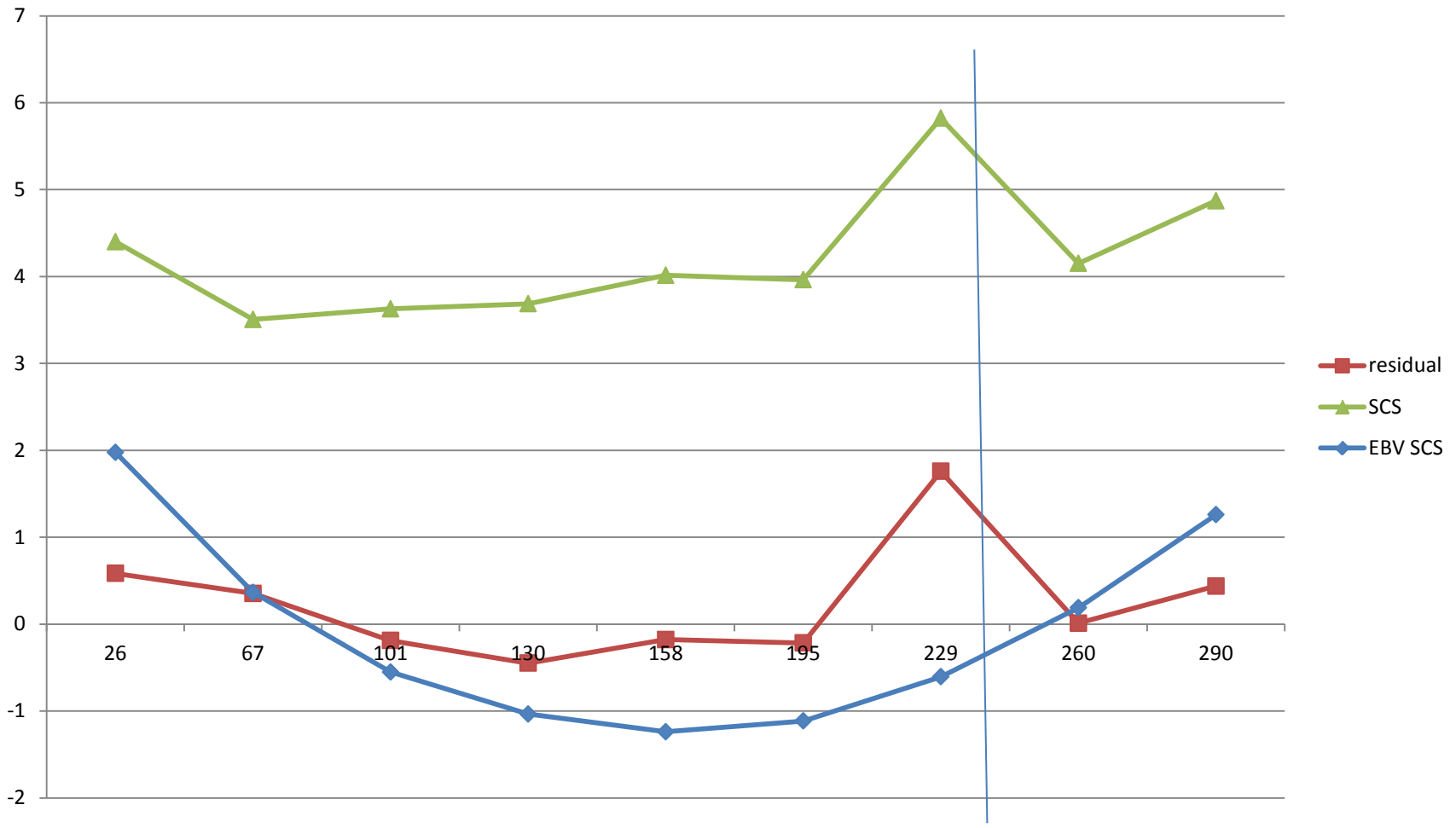
Motivation

- Use of SCS as measure for mastitis:
  - Alternative traits:
  - Excessive values (>500.000 cells/ml)
  - Standard deviation of SCS
  - Genetic correlations were only little higher (.62-.82) to mastitis than direct measurements of SCS (Madsen et al., 2008; Miglior et al., 2012)

Data analysis

- Udder health in Germany:
  - New projects help collecting mastitis results
  - GKuh and BHNP
  - Results give ‚real' mastitis events during a lactation
  - Analysis of ‚real' mastitis and influence on SCC

Mastitis and SCS



Data analysis

- Genetic evaluation model:

$$y_{ijklo} = h_{il} + \sum_{m=1}^{3} \beta_{jlm} f_{jlm} + \sum_{m=1}^{3} b_{klm} a_{klm} + \sum_{m=1}^{3} b_{klm} p_{klm} + e_{ijklo}$$

  - Random-Regression Test-Day model
  - phenotype = environmental effects + genetic effects + residual
  - If single mastitis events are not covered in the genetic model
    - → residual effects contain useful information
    - What else than mastitis can it be?

Data material

- Mastitis records from health trait recording:

Lactation	Mastitis event	No masitis	All
1	12017	14784	26801
2	11943	10757	22700
3	10375	6622	16997
All	32163	34335	66498

Methods

- Trait definition
  - STD = deviation of residuals within a lactation
    - High deviation → one or more mastitis events as residual peak within lactation
  - N_RES = number of residual peaks in lactation (higher that 95% quantile)
  - N_SCS = number of Cell Score peaks (higher that 95% quantile)
  - RZS = relative breeding value SCS

Methods

- Means for analysed traits in lactations with different numbers of mastitis events(*)

mastitis events within lactation	STD	N_SCS	N_RES	RZS
0	0.74	0.22	0.35	105.7
1	1.16	0.55	0.61	103.1
2	1.39	1.11	1.01	100.1

*) all differences are statistically significant with p=0.001

Methods

- Trait definition
  - R^2-analysis to determine influence on target trait
  - Target trait = number of mastitis events within lactation

R-Square	STD	N_SCS	RZS	N_RES
0.1537	X			
0.2012	X	X		
0.2138	X	X	X	
0.2145	X	X	X	X

  - Combiniation of: deviation of residuals and number of cell score peaks
  - STD + N_SCS

Methods

- Genetic model
  - y = hy + lact.nr. + sire + e
  - Two-trait-model:
    - STD and N_SCS
  - Sire model for better convergence
- Genetic parameters estimated:

	STD	N_SCS
STD	0.09	0.76
N_SCS	0.22	0.04

(heritabilities on, r(g) above, r(p) below diagonal

Results

- Estimation of sire-EBVs for mastitis using alternative traits
- Validation of EBV with direct EBV from health recording
- Correlation between breeding values:

	Direct mastitis	STD	N_SCS
Direct mastitis	1	0.34	0.27
STD		1	0.72

- Number of bulls with mastitis recorded daughters is very low

Results

- Mastitis recording currently available for a small fraction of cow population
- Definition of alternative traits for mastitis is useful
- Use of SCS-RRTDM evaluation gives phenotypes for all cows in population
- Using residuals is promising in detecting influences of mastitis not covered by SCS-evaluation
- Alternative traits have heritabilities in expected range
- Validation is difficult because of low number of bulls with reliable EBV for target trait (mastitis)

Results

- More validation data is needed

  If you are interested to support validation with your mastitis data, please contact me!

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