Estimation of variance components of sow longevity traits using discrete time model

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Introduction

• Longevity of sows has a great impact on efficiency of piglet production
• It is also an animal welfare issue
• Commonly used measures of longevity include
  • stayability to certain age
  • length of productive life
  • total number of parities produced before culling

• In practice there are several different culling reason with different genetic background and it is not reasonable to treat them as a same trait
• Using multivariate competing risk analysis it is possible to analyze several traits simultaneously and to estimate correlations between the traits
Objective

• The aim of the study was to estimate (co)variance components of sow longevity traits using a multivariate competing risk model with discrete time to describe the number of parities
Material

- The data were collected from the database of Finnish breeding company Figen Ltd.

- 31,742 Finnish Landrace (LR) sows (+6527 pedigree animals)
- 31,252 Finnish Yorkshire (FY) sows (+5669 pedigree animals)

- Sows were born between 2000 and 2010
- Requirements for accepting the sow into data were:
  - Farm test result available
  - At least first parity (up to 6 parities were considered)
  - If culled, reason for culling
**Traits**

- The data included both complete (the culling date was available) and censored observations.

- Culling was treated as three traits according to culling reason:
  - Leg weakness (Leg) (20% FL, 17% FY)
  - Fertility problems (Fertility) (30% FL, 25% FY)
  - Other reason (Other) (50% FL, 57% FY)

- Pseudo response variables were created for observed discrete times (parities 1 to 6 or culling):
  - 0 if a sow is at risk of being culled but not culled
  - 1 if a sow is culled in that period
Method


• A multivariate survival mixed model with log link function and Poisson distribution was used (DMU program package)

• Fixed effects in the model were
  • parity number
  • year-season
  • size of the herd-year (4 class)
  • age at first farrowing (4 class)
  • litter size

• Random effects:
  • sire (an additive genetic effect)
  • herd-year (a permanent environmental effect)
Results
## Estimated variance components for different culling reasons

<table>
<thead>
<tr>
<th></th>
<th>Landrace</th>
<th>Yorkshire</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \sigma^2 )</td>
<td>SE</td>
</tr>
<tr>
<td>Sire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leg</td>
<td>0.024</td>
<td>0.003</td>
</tr>
<tr>
<td>Fertility</td>
<td>0.012</td>
<td>0.002</td>
</tr>
<tr>
<td>Other</td>
<td>0.010</td>
<td>0.002</td>
</tr>
<tr>
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</tr>
<tr>
<td>Herd-Year</td>
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<tr>
<td>Leg</td>
<td>0.074</td>
<td>0.004</td>
</tr>
<tr>
<td>Fertility</td>
<td>0.099</td>
<td>0.005</td>
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<tr>
<td>Other</td>
<td>0.132</td>
<td>0.006</td>
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<tr>
<td>Dispersion</td>
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</tr>
<tr>
<td>Leg</td>
<td>0.246</td>
<td>0.001</td>
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<tr>
<td>Fertility</td>
<td>0.374</td>
<td>0.002</td>
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<tr>
<td>Other</td>
<td>0.484</td>
<td>0.002</td>
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</table>
Correlations (SE) between the culling reasons

<table>
<thead>
<tr>
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<th>Landrace</th>
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<th>Yorkshire</th>
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<tbody>
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<tr>
<td>Sire</td>
<td></td>
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</tr>
<tr>
<td>Fertility</td>
<td>-0.107 (0.104)</td>
<td>Fertility</td>
<td>0.235 (0.131)</td>
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<tr>
<td>Other</td>
<td>0.198 (0.109)</td>
<td>0.295 (0.123)</td>
<td>0.396 (0.128)</td>
<td>-0.019 (0.134)</td>
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<tr>
<td>Herd-Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertility</td>
<td>0.025 (0.040)</td>
<td>Fertility</td>
<td>0.044 (0.044)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.119 (0.038)</td>
<td>0.047 (0.037)</td>
<td>0.159 (0.041)</td>
<td>0.026 (0.041)</td>
</tr>
</tbody>
</table>
Genetic trends for different culling reasons

Landrace

Yorkshire
Discussion and conclusions

• In some cases culling might have based on several reasons but only the most important was recorded

• Sire variance of the different culling reasons were at the same level in both breeds although variance of the leg were a bit higher
Discussion and conclusions

• There were positive significant genetic correlation between legs and other reason in Landrace (0.3) and between fertility and other reason in Yorkshire (0.4)

• Correlations between different culling reasons might be consequence of same genetic background (e.g. high meat percentage which is correlated with both fertility and leg problems)
Discussion and conclusions

• Genetic trend was first slightly unfavorable and then favorable for legs and for other culling reasons

• There where no clear genetic trend for fertility as a culling reason

• It seems that applied selection for production traits has slightly affected culling for legs and for other reasons but has not increased culling for fertility problems

• Longer production life should be a breeding objective due it’s positive economical and ethical aspects
Acknowledgement

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Thank you for your attention!

Photo from Sika-lehti