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

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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

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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

- The method is described in paper ”Multivariate Survival Mixed models for Genetic Analysis of Longevity traits. 2013. Maia, Madsen and Labouriau. arXiv: 1303.0810v1.
- 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

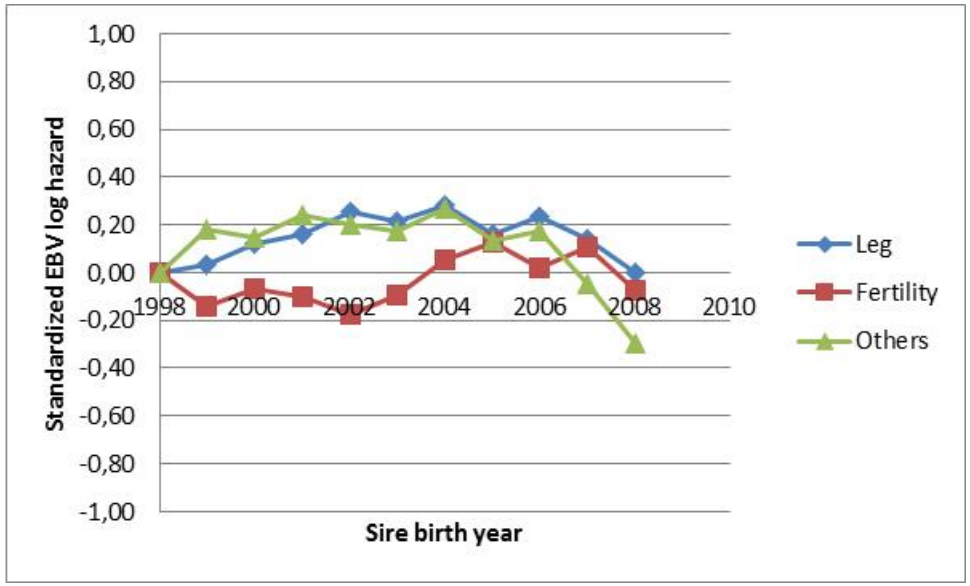
Estimated variance components for different culling reasons

			Landrace			Yorkshire	
			σ^2	SE		σ^2	SE
Sire	Leg		0.024	0.003		0.012	0.002
	Fertility		0.012	0.002		0.015	0.003
	Other		0.010	0.002		0.013	0.003
Herd-Year	Leg		0.074	0.004		0.090	0.005
	Fertility		0.099	0.005		0.107	0.006
	Other		0.132	0.006		0.141	0.007
Dispersion	Leg		0.246	0.001		0.259	0.001
	Fertility		0.374	0.002		0.341	0.002
	Other		0.484	0.002		0.524	0.002

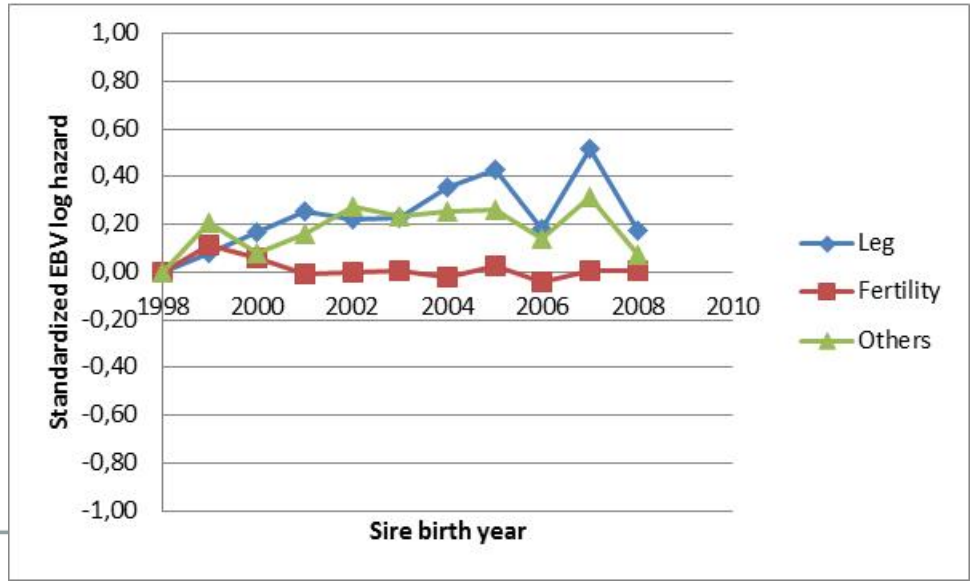
Correlations (SE) between the culling reasons

	Landrace				Yorkshire		
Sire		Leg	Fertility			Leg	Fertility
	Fertility	-0.107 (0.104)			Fertility	0.235 (0.131)	
	Other	0.198 (0.109)	**0.295** (0.123)		Other	**0.396** (0.128)	-0.019 (0.134)
Herd-Year		Leg	Fertility			Leg	Fertility
	Fertility	0.025 (0.040)			Fertility	0.044 (0.044)	
	Other	**0.119** (0.038)	0.047 (0.037)		Other	**0.159** (0.041)	0.026 (0.041)

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

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Acknowledgement

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Thank you for your attention!

Photo from Sika-lehti