

Additive genetic relationship of longevity with growth, post-mortem and morphological traits in the Pirenaica Beef Cattle Breed.

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INTRODUCTION

- Survival is an important trait in cattle.
- Delayed recording.
- Interest on detection of correlated traits.
- Statistical complexity of bivariate analysis with non linear models.
 - Darmgard and Koorsgaard, 2006

INTRODUCTION

- Sequential threshold model
 - Albert and Chib, 2001
 - González Recio and Alenda, 2007
- Easy to implement in large data sets.
- It considers a threshold trait for the survival between discrete units (i.e. calvings)

LONGEVITY DATA (PIRENAICA BREED)

Calving	Records	Culled cows	% culled cows
1	48,965	12,091	24.69 %
2	36,874	8,352	22.65 %
3	28,521	6,430	22.54 %
4	22,091	4,160	23.17 %
5	16,973	3,374	24.51 %
6	12,813	3,374	26.33 %
7	9,439	2,678	28.37 %
8	6,761	2,099	31.05 %
9	4,662	1,605	34.43 %
10	3,057	1,208	39.52 %
11	1,849	795	43.00 %
12	1,054	520	49.34 %
13	534	267	50.00 %
14	267	136	50.94 %
>14	131	99	75.57 %

DATA

Trait	N	Mean	SD
BIRTH WEIGHT (BW)	61,833	41.67	4.85
WEIGHT AT 120 DAYS (W120)	25,812	163.48	42.29
WEIGHT AT 210 DAYS (W210)	18,435	263.88	58.36
COLD CARCASS WEIGHT (CCW)	29,109	301.05	56.35
CONFORMATION (CON)	24,912	3.698	0.472
FATNESS (FAT)	22,845	2.196	0.495
COLOR (COL)	5,278	2.279	0.382
TEAT THICKNESS (TT)	1,932	2.472	0.846
TEAT LENGTH (TL)	2,412	4.245	1.598
UDDER DEPTH (UD)	2,412	3.515	1.736
BACKWARD LEGS (BL)	2,412	5.580	1.291
FORWARD LEGS (FL)	2,412	5.488	1.208
MILK	2,412	5.960	1.520
DOCILITY (DOC)	2,412	5.067	2.133

SEQUENTIAL THRESHOLD MODEL

$$y_i = \begin{cases} 1 & \text{if } \omega_{i1} \leq \gamma_1 \\ 2 & \text{if } \omega_{i1} > \gamma_1, \omega_{i2} \leq \gamma_2 \\ 3 & \text{if } \omega_{i1} > \gamma_1, \omega_{i2} > \gamma_2, \omega_{i3} \leq \gamma_3 \\ \vdots & \\ \text{so on} & \end{cases}$$

STATISTICAL MODEL

$$\omega = \gamma + \mathbf{X}_\omega \mathbf{b}_\omega + \mathbf{Z}_\omega \mathbf{u}_\omega + \mathbf{W}_\omega \mathbf{p}_\omega + \mathbf{e}_\omega$$

$$\mathbf{y} = \mathbf{X}_g \mathbf{b}_g + \mathbf{Z}_g \mathbf{u}_g + \mathbf{e}_g$$

$$p(\mathbf{p}_\omega | \sigma_{p_\omega}^2) \sim N(0, \mathbf{I} \sigma_{p_\omega}^2) \qquad p(\mathbf{e}_\omega | \mathbf{I}) \sim N(0, \mathbf{I})$$

$$p\left(\begin{matrix} \mathbf{u}_\omega \\ \mathbf{u}_g \end{matrix} \middle| \mathbf{A}, \mathbf{G}\right) \sim N(0, \mathbf{A} \otimes \mathbf{G})$$

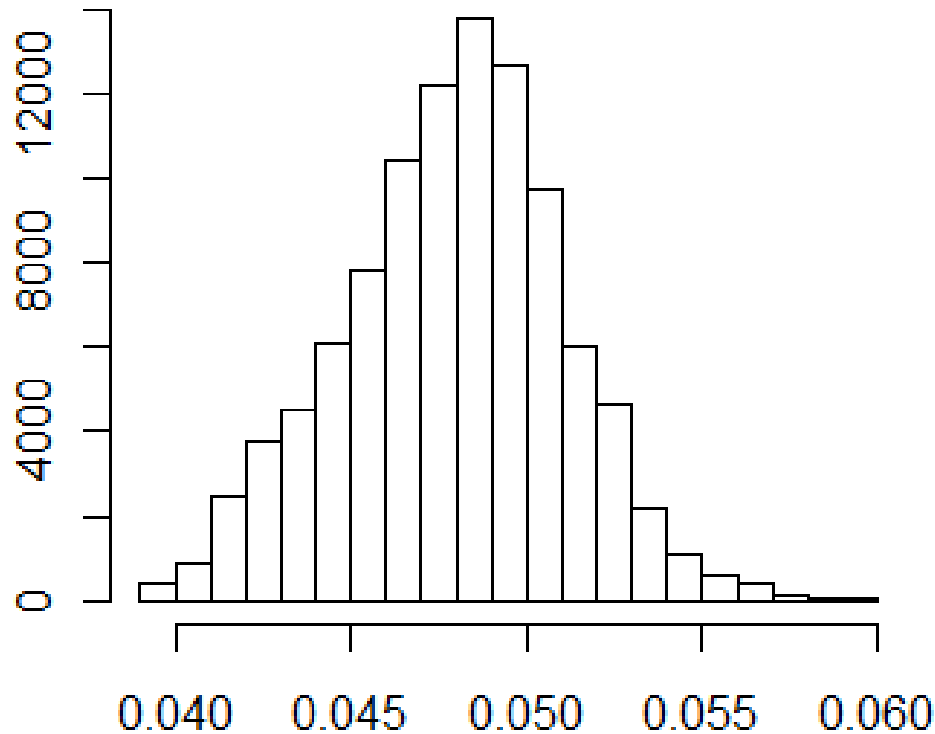
SYSTEMATIC EFFECTS - LONGEVITY

- ORDER OR PARITY (15 levels)
- SEX OF CALF (Male vs Female)
- TYPE OF PARITY (No help vs help)
- YEAR (51 levels)
- FARM (1964 levels)
- SEASON (4 levels)

SYSTEMATIC EFFECTS

Trait	Sex	CG	Age	Slaughterhouse	Evaluator
SURV	X	X			
BW	X	X	X	-	-
W120	X	X	X	-	-
W210	X	X	X	-	-
CCW	X	X	X	X	-
CON	X	X	X	X	-
FAT	X	X	X	X	-
COL	X	X	X	X	-
TT	-	X	X	-	X
TL	-	X	X	-	X
TD	-	X	X	-	X
BL	-	X	X	-	X
FL	-	X	X	-	X
MILK	-	X	X	-	X
DOC	-	X	X	-	X

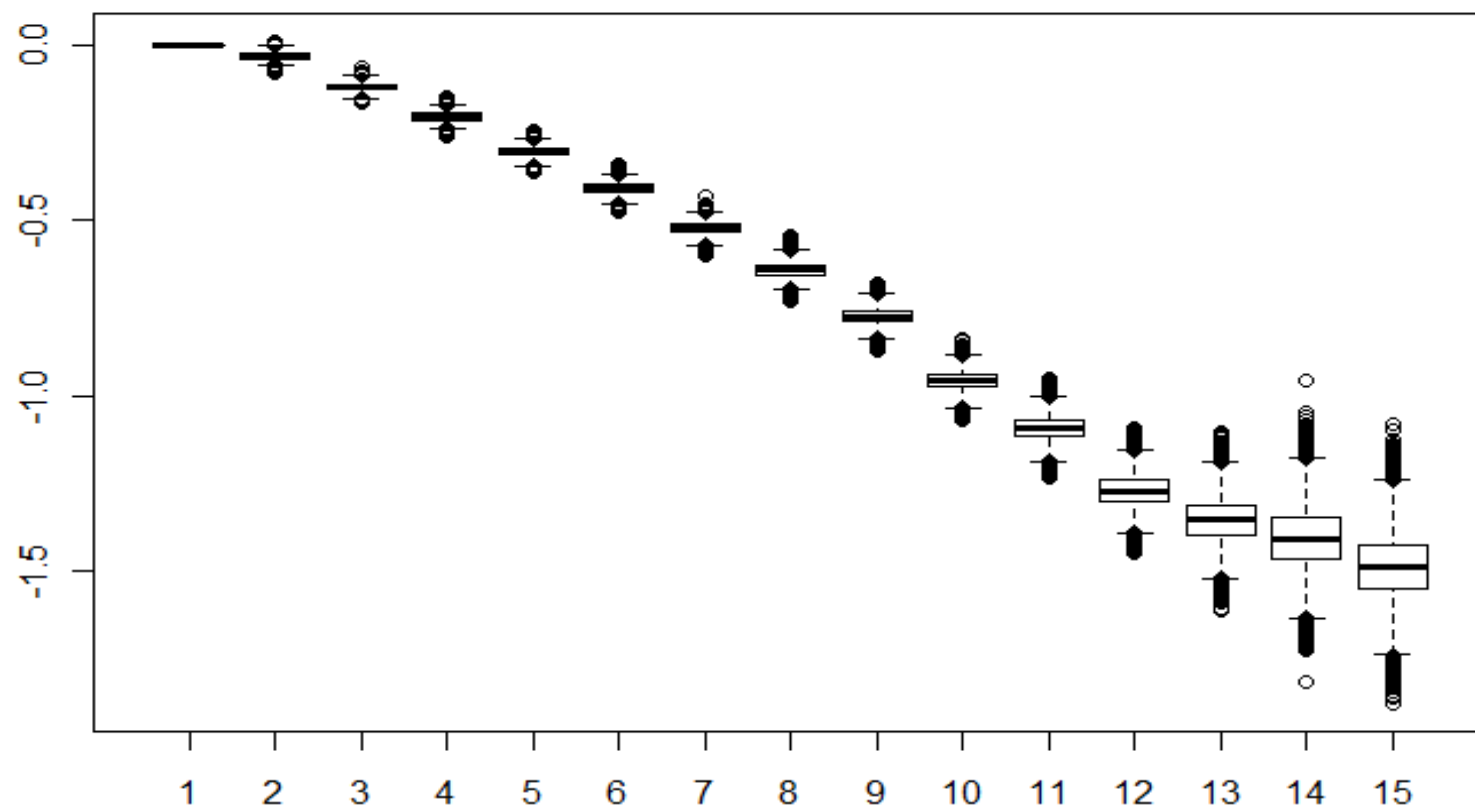
SURVIVAL HERITABILITY



Posterior Mean: 0.048

Posterior SD: 0.003

ORDER OF PARITY



HERITABILITIES

Trait	Va	Ve	Heritability
BW	7.091 (0.223)	13.089 (0.154)	0.351 (0.009)
W120	335.645 (17.406)	609.983 (12.471)	0.355 (0.016)
W210	677.700 (39.793)	1226.795 (29.878)	0.356 (0.018)
CCW	460.254 (26.127)	870.463 (19.731)	0.346 (0.017)
CON	0.036 (0.004)	0.116 (0.003)	0.239 (0.025)
FAT	0.033 (0.003)	0.122 (0.002)	0.211 (0.017)
COL	0.010 (0.002)	0.107 (0.003)	0.086 (0.017)
TT	0.127 (0.026)	0.330 (0.024)	0.277 (0.053)
TL	0.614 (0.073)	1.510 (0.078)	0.289 (0.032)
UD	0.466 (0.073)	0.844 (0.063)	0.355 (0.051)
FL	0.108 (0.036)	1.189 (0.046)	0.084 (0.027)
BL	0.254 (0.059)	1.232 (0.061)	0.170 (0.038)
MILK	0.355 (0.081)	1.374 (0.078)	0.205 (0.044)
DOC	0.558 (0.097)	2.318 (0.110)	0.194 (0.033)

GENETIC CORRELATIONS

Trait	rg	SD
SURV x BW	-0.068	0.041
SURV x W120	0.123	0.047
SURV x W210	0.103	0.054
SURV x CCW	0.151	0.051
SURV x CON	-0.178	0.064
SURV x FAT	0.332	0.058
SURV x COL	0.265	0.147
SURV x TT	-0.013	0.096
SURV x TL	0.119	0.092
SURV x UD	0.096	0.080
SURV x FL	0.029	0.112
SURV x BL	0.115	0.116
SURV x MILK	-0.037	0.126
SURV x DOC	0.083	0.114

CONCLUSIONS

- Selection for weight increase longevity
- Selection for conformation reduces longevity
- Fatness is the best indicator for survival
- More data are needed for docility and morphological traits