Genetic parameters for large scale behavior traits in Charolais beef cows

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Breeding goal in beef cattle

- In the last decades: traits directly related with profitability

  (Phocas et al., 1995; Phocas et al., 1998)

  - Production
  - Reproduction

- Nowadays: interest for behavior

  (Forabosco et al. 2007; Vargas et al. 2014)

  - Agressiveness toward farmer
  - Maternal care

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Interest for behavior traits in beef cattle

- Agressiveness toward farmer related to

    (Le Neindre et al., 2002; Turner et al., 2013)

    - Human safety
    - Workability

- Maternal care related to

    (Frisch, 1982; Hoppe et al., 2008)

    - Colostrum consumption
    - Immunity
    - Calf survival

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Recording behavior traits in beef cattle

- In literature, scored by trained and experienced classifiers

  (Hoppe et al., 2008; Benhajali et al. 2010; Schmidt at al., 2014)

  - Limited number of records
  - Limited accuracy of the genetic estimates

- If scoring by farmers

  - More records
  - Successfully implemented in dairy for temperament during milking

    (Beard, 1993)

Objectives

1. Estimate heritabilities and genetic correlations for behavior traits in Charolais

2. Assess the possibilities of selection using a simple on-farm recording system

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Data

- 6,649 Charolais cows
  From 76 AI sires and 6,080 dams
  From 380 herds in France

- 3 behavior traits: recorded by farmers
  Based on their experience in handling animals

- Cows on one herd were scored by the same farmer
  Collected from October 2010 to September 2011

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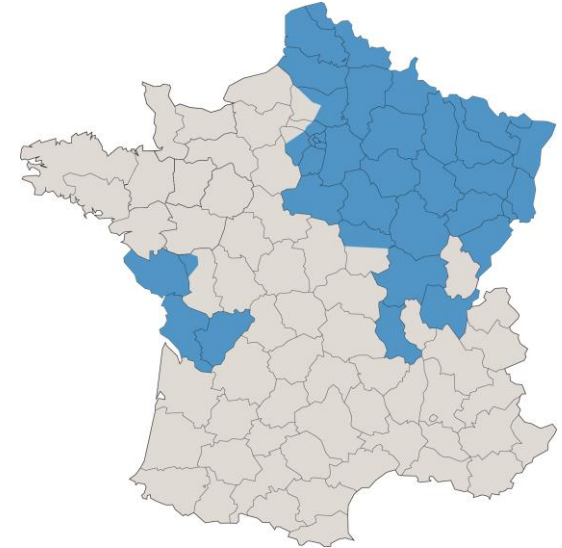
Behavior traits

Traits	Scale
Aggressiveness during gestation	1 (aggressive) to **7** (docile)
Aggressiveness at parturition	1 (aggressive) to **7** (docile)
Maternal care	1 (rejection) to **7** (attentive)

7= optimal grade

Animal Model

- Fixed effects
  - Parity (6 classes: 1, 2, 3, 4, 5, ≥6)
  - Birth Year by Birth Season (26 classes)
    between 1997 and 2009, and two six-months periods
    starting in October

- Random effects
  - Herd
  - Animal

- A matrix constructed with minimum of 3 generations

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Analysis

- Univariate analysis for each trait

$$h^2 = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_e^2}$$

$$\% \, \sigma_{herd}^2 = \frac{\sigma_h^2}{\sigma_a^2 + \sigma_h^2 + \sigma_e^2} * 100$$

$$CV_a = \frac{\sigma_a}{\mu} \qquad \text{(Houle, 1992)}$$

- Bivariate analysis between different traits

$$r_g$$

- ASReml (Gilmour et al., 2009)

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Means and standard deviations

Trait	Mean	SD	% σ^2_{herd}	h² (SE)	CV$_a$ (%)
Aggres. gestation	**5.74**	**0.89**	23	0.06 (0.02)	4
Aggres. parturition	**5.03**	**1.33**	19	0.19 (0.05)	11
Maternal care	**4.56**	**0.89**	21	0.02 (0.01)	2

- Higher SD for aggressiveness at parturition
  - More handling experience and used a wider range of scores

Herd effect

Trait	Mean	SD	% σ^2_{herd}	h² (SE)	CV$_a$ (%)
Aggres. gestation	5.74	0.89	**23**	0.06 (0.02)	4
Aggres. parturition	5.03	1.33	**19**	0.19 (0.05)	11
Maternal care	4.56	0.89	**21**	0.02 (0.01)	2

- Substantial for all traits

- Could be due to difference
  - In management: housing system and Human contact

    (Boivin et al., 1994; Becker and Lobato, 1997)
  - In scoring between farmers (Le Neindre et al., 1995; Phocas et al., 2006)

Heritabilities

Trait	Mean	SD	% σ^2_{herd}	h² (SE)	CV$_a$ (%)
Aggres. gestation	5.74	0.89	23	**0.06 (0.02)**	4
Aggres. parturition	5.03	1.33	19	**0.19 (0.05)**	11
Maternal care	4.56	0.89	21	**0.02 (0.01)**	2

- h² lower than in literature
  - Objective scoring system (Le Neindre et al., 2002; Phocas et al., 2006)
  - h² declines with habituation to human contact
    (Burrow and Corbet, 2000)
- Higher h² for aggressiveness at parturition
  - Observation is more accurate

Genetic and phenotypic correlations

Trait	Aggres. gestation	Aggres. parturition	Maternal care
Aggres. gestation	-	**0.98 (0.03)**	**-0.71 (0.21)**
Aggres. parturition	**0.52 (0.01)**	-	**-0.87 (0.13)**
Maternal care	**-0.11 (0.01)**	**-0.23 (0.01)**	-

SE in ()

- Strong genetic correlations

- Supported by literature in a lower extend

  (Morris et al., 1994; Le Neindre et al.,2002; Phocas et al. 2006)

- Difficulty to simultaneously improve maternal care and reduce aggressiveness

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Opportunity for selection

Trait	Mean	SD	% σ^2_{herd}	h² (SE)	CV$_a$ (%)
Aggres. gestation	5.74	0.89	23	0.06 (0.02)	**4**
Aggres. parturition	5.03	1.33	19	0.19 (0.05)	**11**
Maternal care	4.56	0.89	21	0.02 (0.01)	**2**

- CV$_a$ high for agressiveness at parturition

  - 5% for body weight in Charolais   (Mujibi et al. 2009; Phocas, 2009)

  - Opportunity for selection

  - Opportunity to collect simple data scored by farmers

Thank you for your attention

Difference between young and old cows

Trait	Parity 1 (2,300 cows)			Parity ≥ 4 (2,004 cows)			r_g (SE)	p-value*
	σ_a^2	σ_p^2	h²	σ_a^2	σ_p^2	h²		
Aggres. gest.	0.02	0.47	0.03	0.05	0.70	0.07	0.68 (0.56)	0.57
Aggres. part.	0.00	0.83	0.00	0.31	1.99	0.16	0.46 (1.45)	0.97
Maternal care	0.02	0.68	0.04	0.01	0.56	0.02	0.24 (0.92)	0.43

■ No evidence for genetic difference but large SE * from Likelihood ratio test

■ Reduced variance for Maternal care
- Cows with unfavourable phenotype are likely to be culled

■ Increased variance for Agressiveness
- Wider range of score used for older cows
- Observation for older cows is more accurate