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Estimation the genetic parameters for calving score using a threshold model, in Charolais breed

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Abstract: *The aim of this study was to determine the breeding value and heritability for calving score using a threshold model for population from Charolaise breed. In this study were used records obtained from 2935 calves of Charolais breed from Romanian Breeding Association for Beef cattle. The mean for calving score was 1.35± 0.010. The breeding values for calving score for calves were ranged between -0.2749 and 0.3606. The heritability for calving score was low 0.139. The threshold model was a method of analysis for categorical trait calving score*.

• Introduction

Calving ease is an important trait in beef cattle breed for health of calf and dam. This trait is correlated with birth weight. Calving difficulty has a great percentage in the first parity of cows. Charolais is a breed from France used for beef production, it had spread in many countries in the world.

• Material and method

The data from 2935 Charolais calves in the year 2021 were used in this study. The pedigree covered 6022 animals: 2935 calves, 194 bulls and 2893 dams from Romanian Breeding Association for Beef cattle. Calving ease can range from unassisted calving to difficult calving. In our study were three categories of calving:
1-is unassisted calving, 2 is assistance required and 3 is difficult calving. The model used is threshold model (Grosu et al., 2013, [2]) described as follows:

$$\lambda_{ijkl} = f(t)_i + S_j + H_k + a_l + e_{ijkl}$$

λ_{ijkl} = is unknown, underlying liability value for calf l, of sex j, in herd k
$f(t)_I$ = is a function of the thresholds and probabilities of the calving score belonging to category i
S_j= is a sex of calf effect
H_K= is a herd effect
a_l = is a calf additive genetic effect
e_{ijkl} = is a residual error effect
Let the model be written in matrix notation as:

$$\lambda = Ft + Xb + Zu + e$$

λ = is the vector of unobserved liabilities of each animal,
t = is the vector of m-1 thresholds,
b =is the vector of fixed effects in the model
u = is the vector of random effects, including random animal additive genetic effects
e = is the vector of random residuals, assumed to have mean 0 and variance of 1,
F = is a matrix of probabilities of an animal being in the various categories resulting in a function of the unknown thresholds
X, Z = are the usual design matrices of a linear model
The model included the fixed effects: the sex and the herd. The sex has two levels: female and male. The levels of effect herd were 164.

• Results and discussions

The proportions of calves were 68,45% for score 1 (unassisted calving), 27.67% for score 2 (assisted calving) and 3.88% for score 3 (difficult calving). Tomka, 2018 presented the main factors affecting calving difficulty include calf size, pelvic measures of the cow, their compatibility, breed, parity of the calving, sex of the calf, gestation length and the season of the calving.

Table 1. The breeding value of the 10 best calves Charolais for calving score

No.	Breeding value
1	-0.2749
2	-0.2515
3	-0.2515
4	-0.2440
5	-0.2415
6	-0.2335
7	-0.2335
8	-0.2335
9	-0.2335
10	-0.2335

Table 2. The heritability of Charolais population for calving score

Trait	h2
Calving score	0.139

In practice it is necessary to identify the sire whose calves will be born without assistance. The improvement of reproduction traits as calving ease determined the increase of the profit of farmers. Estimating breeding value of cattle for calving ease determine to rank cattle and select them for breeding program.

Conclusions

The calving score is an important economic trait in Charolais breed. The heritability of calving score was low in Charolais breed in our study. The threshold model was adequate model for estimation the genetic parameters and breeding value prediction for calving score in Charolais breed.

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