DEMOGRAPHIC ANALYSIS OF THE ALENTEJANA BREED OF CATTLE

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INTRODUCTION

Animal genetic resources represent an integral part of agricultural activities, playing a major role in rural development and local traditions, and several arguments can be presented in favour of their conservation (Ponzoni, 1997). Within-breed genetic variability is an important component of the diversity of animal genetic resources, and recommendations have been made to manage populations at risk (FAO, 1998; Toro and Maki-Tanila, 1999).

Relative to its size, Portugal is a very heterogeneous country, with several breeds well adapted to specific local conditions. Among cattle native breeds, the Alentejana is the more representative, with about 8000 active females registered in the herdbook (established in 1972). This breed is characterized by a large mature size (Carolino et al., 1993), and it is very well adapted to the conditions prevailing in Southern Portugal.

Demographic analyses, for example based on pedigree information, are important tools to evaluate the management practices affecting the risk of genetic erosion and to establish a conservation strategy for a breed (Meuwissen, 1999). The objectives of this work were to analyse herdbook information available for the Alentejana cattle breed, in order to better understand its dynamics and identify some of the major factors threatening its genetic diversity.

MATERIALS AND METHODS

Information from the herdbook was used to compute different demographic criteria, in order to study the evolution of the breed over the last years. In addition to herdbook information, pedigree records dating back to the 1940’s from some of the more influential herds were also used.

In total, records from 70696 animals from 138 herds were used to obtain information on evolution of number of registered animals over time and farm size, and to compute generation intervals for all calves and for different paths of selection. The number of generations known per animal \( n_i \) was obtained as \( n_i = ((n_s + n_d)/2)+1 \), where \( n_s \) and \( n_d \) are the number of generations known for the sire and dam, respectively, which take a value of –1 in case the parent is unknown. Individual inbreeding was computed from the relationship matrix (Van Vleck, 1993) and the regression of inbreeding on year of birth was obtained to estimate the rate of inbreeding per year \( \Delta F_y \). This \( \Delta F_y \) was then multiplied by the average generation interval to calculate the rate of inbreeding per generation \( \Delta F_g \). Effective population size \( N_e \) was computed as \( N_e = 1/2\Delta F_g \) (Falconer and McKay, 1996).
RESULTS AND DISCUSSION
The evolution of number of calves registered and number of herds in the herdbook over the last 20 years is in Figure 1. The number of herds has stabilized around 100 over the last few years, but the number of purebred calves registered annually has increased steadily to above 6000. Even though the majority of the herds have a number of breeding cows ranging between 70 and 100, about 35% of the farms produce less than 10 purebred calves per year. Nevertheless, nearly 65% of the calves are produced by herds with more than 50 cows.

Figure 1. Number of calves and herds registered in the herdbook, by year

More than 95% of the calves born over the last 20 years have parents known, and between 40 and 66% have great-grandparents also available. On average, calves born in 1999 had 4.5 generations known (Figure 2).

Overall, 713 bulls had offspring registered, and 4 bulls had more than 500 calves. In terms of genetic contributions, 2 bulls contributed with about 12% of the current gene pool of the breed. The average age of active cows and bulls in the herdbook was 6.9 and 6.1 years, respectively, and the generation intervals for the four paths of selection are in Table 1.

Average inbreeding was about 1% in calves born in 1980, and reached nearly 8% in calves born in 1999 (Figure 2); almost 45% of the calves born between 1980 and 1999 were inbred, with average inbreeding of 13.8%. The percentage of inbred calves increased to nearly 60% in animals born between 1995 and 1999.

A trend for an increase in inbreeding was clear, with a rate of inbreeding per year of 0.33%. Based on the rate of inbreeding per year and the average generation interval, the rate of inbreeding per generation was calculated to be 2.12%. From this, the effective population size was estimated to be of 23.6 individuals.
Table 1. Generation intervals for paths of selection

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<th>Sires</th>
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<tr>
<td>Bulls</td>
<td>6.1</td>
<td>6.9</td>
</tr>
<tr>
<td>Cows</td>
<td>5.9</td>
<td>6.7</td>
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<tr>
<td>Calves</td>
<td>6.1</td>
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Figure 2. Mean inbreeding and number of generations known, by year of birth of calves

The observed inbreeding is quite high, especially when one considers that the actual size of the population is about 8000 breeding females. Nevertheless, the heavy use of some bulls has resulted in a dramatic decrease in heterozygosity in this population, which may hamper its future ability to maintain adequate fitness and productive ability.

CONCLUSIONS

The rate of inbreeding per generation observed in the Alentejana breed is about twice as much as what has been recommended as tolerable by the FAO (1998). The corresponding effective population size is extremely small, and both indicators strongly urge that measures should be taken to avoid further reductions in the genetic diversity of the Alentejana breed.

REFERENCES


