

ANIMAL GENETICS

Indicators of genetic erosion in an endangered population: The Alentejana cattle breed in Portugal¹

N. Carolino* and L. T. Gama^{*,†,2}

* Estação Zootécnica Nacional, Fonte Boa, 2005-048 Vale de Santarém, Portugal; and †
Faculdade de Medicina Veterinária, Universidade Técnica de Lisboa, 1300 Lisboa, Portugal

² Corresponding author: genetica.ezn@mail.telepac.pt

A study was conducted to characterize genetic diversity in the Alentejana breed of cattle based on its demographic trends and to investigate the major factors affecting genetic erosion in this breed. Herdbook information collected between 1940 and 2004, including pedigree records on 100,562 animals in 155 herds, was used to estimate demographic parameters. The mean generation intervals were 6.0 ± 2.4 yr and 6.8 ± 3.2 yr for sires and dams of calves, respectively. Average inbreeding increased steadily over the period analyzed, with an annual rate of inbreeding of $0.33 \pm 0.004\%$ ($P < 0.01$) and an effective population size of 23.3.

In the reference population (28,531 calves born between 2000 and 2003) the average inbreeding was $8.35 \pm 9.02\%$ and nearly 80% of the calves were inbred, whereas the average relationship among all animals was 0.026 ± 0.040 . Nevertheless, the mean relationship was 0.328 ± 0.264 and 0.022 ± 0.026 for animals born in the same and in different herds, respectively. The computed genetic contributions to the reference population resulted in estimates for the effective number of founders, ancestors, founding herds, and herds supplying sires of 121.6, 55.0, 17.1, and 26.9, respectively, the 2 most influential herds and ancestors contributing 24.2 and 15.1%, respectively, of the current genetic pool. Of the 671 founding sires, only 24 Y-chromosomes are currently represented, but 1 sire alone contributes nearly 60% of this representation, such that the effective number of Y-chromosomes is only 2.73. The observed inbreeding per herd was, on average, 0.053 ± 0.071 lower than expected from the relationship among the generation of parents of calves in the reference population, indicating that producers have followed breeding strategies that have kept inbreeding at lower levels than anticipated with random selection and mating. When compared with other cattle breeds, Alentejana has some of the highest levels of mean inbreeding and annual rate of inbreeding, and an effective population size that is nearly half of the minimum recommended for maintenance of genetic variability. These critical indicators demonstrate the need to adopt strategies aimed at minimizing inbreeding to avoid further losses of genetic diversity.

Key Words: Alentejana • cattle • genetic diversity • inbreeding • population structure