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Variation at post-albumin, transferrin and haemoglobin proteins in Moroccan local sheep

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ABSTRACT

Blood biochemical polymorphism of six Moroccan local sheep breeds was studied using three electrophoretic systems: post-albumin, transferrin and haemoglobin Beta. A total of 1263 blood samples from Timahdite, Béni Guil, Sardi, D'man, Béni Ahsen and Boujaâd were tested. All loci sampled were found to be polymorphic. The post-albumin and haemoglobin beta loci exhibited three alleles each, and the transferrin locus showed six to nine alleles. The mean expected heterozygosity varied from 0.331 to 0.491. Genetic distances between breeds, estimated using Cavalli-Sforza's chord measure, were within the range 0.006–0.026. It was concluded that based on the average heterozygosity, D'man, Sardi and Béni Guil breeds may play an important role for the management of Moroccan sheep genetic resources.

1. Introduction

The total sheep population in Morocco is more than 16 million heads. It is constituted by several local breeds among which six represent 40% of the total population. The six breeds are (Boujenane, 1999, 2005):

- Timahdite which has brown face, white, coarse fleece, and white legs. The tail is thin and horns are present in rams, but ewes are polled.
- Béni Guil has brown, large face, brown legs, and white, open fleece of medium fineness. The breed is thin-tailed, and rams have fairly well developed spiral horns.
- The Sardi breed has animals with white heads and black spots around the nose, mouth and eyes; is thin-tailed and the rams have strong spiral horns. The body fleece is white and the legs are bare.
- D'man fleece is characteristically entirely black although some animals are brown, white or various combinations of two or all three colours. Both sexes are polled. The breed is thin-tailed.
- The Béni Ahsen has a brown face with a strong head conformation, and males have horns. The fleece is white. The neck is long with a pronounced fold and dewlap. The breed is thin-tailed.
- The Boujaâd sheep have white to yellowish face with a white fleece. Rams have large horns. The breed is thin-tailed.

The geographical distribution of these sheep breeds is represented in Fig. 1.

So far, the distinction between these breeds is based on phenotypic characteristics and body morphology. However, these traits give a rough indication on the breed because they are affected by environmental factors and their inheritance is complex. In contrast, electrophoretic variants of blood proteins have a simple genetic transmission (Nguyen, 1979). Moreover, no information is yet available on the

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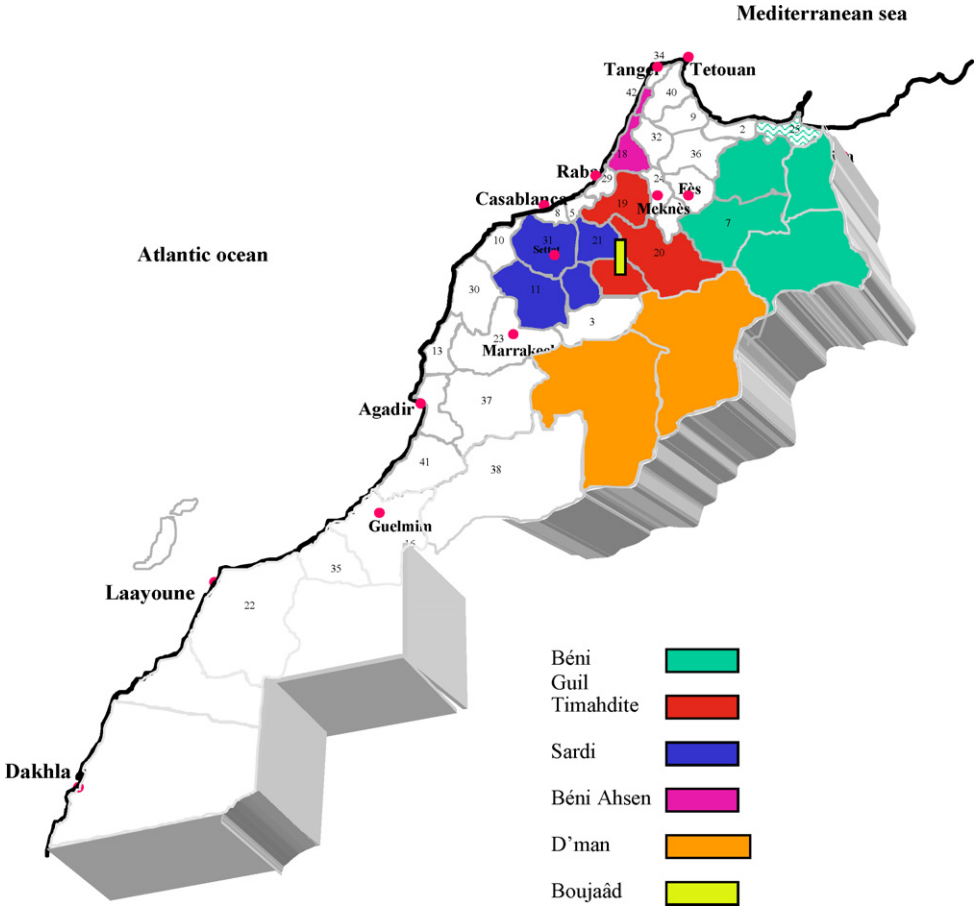

Fig. 1. Geographical distribution of six Moroccan local sheep breeds.

blood protein polymorphism in Moroccan local sheep and their phylogenetic relationships.

This study was undertaken to analyse the genetic diversity at three loci controlling blood polymorphism in the six most important Moroccan sheep breeds differing in phenotypic appearance, productive performance and breeding area, and to estimate the genetic distances between them.

2. Materials and methods

2.1. Animals

Blood samples were taken from 1263 adult sheep of both sexes, representing Timahdite (200), Béni Guil (200), Sardi (212), Boujaâd (204), D'man (232) and Béni Ahsen (214) Moroccan local breeds, respectively. Samples were collected from unrelated animals of 51 flocks (10 Timahdite, 10 Béni Guil, 8 Sardi, 8 Boujaâd, 8 D'man and 7 Béni Ahsen) covering the entire breeding area of each breed. All the individuals fit the corresponding phenotypic breed type.

2.2. Laboratory analyses

Blood was collected from the jugular vein in tubes containing EDTA, kept refrigerated during the transport and centrifuged at 4 °C. Separate aliquots of plasma and erythrocytes were stored at −20 °C until they were analysed. Post-albumin (GC) and transferrin (TF) typing were performed using the polyacrylamide gel electrophoresis (PAGE, pH 8.9) as described by Gahne et al. (1977). Haemoglobin beta (HBB) analysis was performed using the polyacrylamide gel isoelectric focusing (PAG-IEF) (Ryder et al., 1979).

2.3. Data analyses

Allele frequencies were obtained by simple gene counting. Estimates of expected heterozygosity at different loci were determined according to Nei's formula (1973). Possible deviation from Hardy–Weinberg equilibrium at loci investigated was tested using the χ^2-test. Cavalli-Sforza and Edwards (1967) chord genetic distance was used for phylogenetic reconstruction using the UPGMA method. Bootstrap resampling using 1000 replicates was performed to test the reliability of each node. Computation was done using the PHYLIP software, version 3.65 (Felsenstein, 2004). The TREEVIEW programme (Page, 1996) was used for tree drawing.

3. Results

3.1. Genetic variability within breeds

Observed alleles at the three blood protein loci and their frequencies are presented in Table 1. A total of 15 alleles were observed at the investigated loci. All loci sampled were found to be polymorphic. The highest number of alleles occurred at the transferrin locus (9 alleles) and the lowest number occurred at the post-albumin and haemoglobin beta loci (3 alleles each). The mean number of