



Inferring the population structure of the Maghreb sheep breeds using a medium-density SNP chip

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Summary

North Africa has a great diversity of indigenous sheep breeds whose origin is linked to its environmental characteristics and to certain historical events that took place in the region. To date, few genome-wide studies have been conducted to investigate the population structure of North African indigenous sheep. The objective of the present study was to provide a detailed assessment of the genetic structure and admixture patterns of six Maghreb sheep populations using the Illumina 50K Ovine BeadChip and comparisons with 22 global populations of sheep and mouflon. Regardless of the method of analysis used, patterns of multiple hybridization events were observed within all North African populations, leading to a heterogeneous genetic architecture that varies according to the breed. The Barbarine population showed the lowest genetic heterogeneity and major southwest Asian ancestry, providing additional support to the Asian origin of the North African fat-tailed sheep. All other breeds presented substantial Merino introgression ranging from 15% for D'man to 31% for Black Thibar. We highlighted several signals of ancestral introgression between North African and southern European sheep. In addition, we identified two opposite gradients of ancestry, southwest Asian and central European, occurring between North Africa and central Europe. Our results provide further evidence of the weak global population structure of sheep resulting from high levels of gene flow among breeds occurring worldwide. At the regional level, signs of recent admixture among North African populations, resulting in a change of the original genomic architecture of minority breeds, were also detected.

Keywords admixture, genetic diversity, North African sheep, single nucleotide polymorphism

Introduction

Sheep (*Ovis aries*) were domesticated for the first time about 10 500 years ago (YBP) from Asian mouflon (*Ovis orientalis*) in the Fertile Crescent (Alberto *et al.* 2018). Archaeological evidence suggests that sheep were introduced into the African continent from the Fertile Crescent through the Sinai Peninsula approximately 7000 YBP along with human migrations. Later, they spread northward to Libya

(6500–6800 YBP) and reached West Africa by 3700 YBP, crossing the central Sahara (Muigai & Hanotte 2013). Currently, the Maghreb region (namely current Morocco, Algeria, Tunisia and Libya) is endowed with many diverse indigenous sheep breeds. Many of them are common to two or more countries (such as the Barbarine population, which is raised in Tunisia, Libya and Algeria, or that of D'man, which is raised both in Algeria and Morocco and, more recently, in Tunisia). Throughout its history, North Africa has been influenced by contact with other peoples through several waves of settlers: Greeks, Egyptians, Phoenicians, Romans, Vandals, Arabs and Europeans. These migration waves were often accompanied by hybridization between endemic and foreign breeds imported by settlers into the area, thus reshaping the genetic architecture of North African sheep. Sicilo-Sarde (SS) is the most recent introduction of

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