

Genetic characterization of Cuban Creole cattle using molecular tools

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REPORT

ABSTRACT

The bovine Cuban Creole is product of the prolonged almost empirically directed process of natural selection, of the descendants of the cattle *Bos taurus* brought by the Spaniards conquerors and of animal coming from Africa, with genes *Bos indicus*. The present study sustains the Cuban Creole bovine characterization through typing tools of six milky proteins, random amplified polymorphic DNA markers, 30 microsatellite *loci*, the D-loop region of the mtDNA and six Y chromosome microsatellites. It was confirmed the presence of *Bos indicus* genes in the Cuban Creole, supposedly pure *Bos taurus*, with genetic potential to be used in programs to improve the quality of milk; there is a high genetic variability in the breed with proper alleles of the race and an intermediate profile between both uniparental ascendances by the mtDNA haplotypic composition; the molecular variation of the Y chromosome demonstrates a recent process of introgression of the mediated Zebu males, which agrees with its historical origin. The molecular characterization of genetic material of interest for the bovine Cuban Cattle was obtained for the very first time, with almost the totality of the markers available for this aims, which is an important contribution to the knowledge of the genetic characteristics of the Creole cattle in Cuba. It also contributes with valuable information on its genetic variability as a starting point for the design and development of programs to improve and increase the productive indicators and establish the bases for the development of this Cuban native race conservation programs, *in situ* or *ex situ*.

Keywords: Cuban Creole bovine cattle, molecular markers

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RESUMEN

Caracterización genética del ganado Criollo Cubano a través de herramientas moleculares. El ganado bovino Criollo Cubano es producto del prolongado proceso de selección natural casi empíricamente dirigido, de los descendientes del ganado *Bos taurus* traído por los españoles a Cuba y del ganado procedente de África, con genes *Bos indicus*. Esta propuesta sustenta la caracterización del ganado bovino Criollo Cubano mediante herramientas de tipificación de seis proteínas lácteas, marcadores de polimorfismos de ADN amplificados aleatoriamente, 30 *loci* de microsatélites, la región D-loop del ADNmt y seis microsatélites del cromosoma Y. Se confirmó la presencia de genes de *Bos indicus* en el Criollo Cubano, supuestamente *Bos taurus* puro, con potencial genético para ser utilizado en programas de mejora de la calidad de la leche. Existe elevada variabilidad genética en el rebaño, con alelos propios de la raza y un patrón intermedio entre ambos extremos uniparentales por la composición haplotípica del ADNmt. La variación molecular del cromosoma Y evidencia un proceso reciente de introgresión del ganado Cebú, mediada por los machos, lo que concuerda con su origen histórico. Por primera vez se logra la caracterización molecular de un genofondo de interés para la ganadería cubana, con casi todos los marcadores disponibles para estos fines. Esta es una valiosa contribución al conocimiento de la variabilidad genética del ganado Criollo de Cuba, como punto de partida y base para el diseño y desarrollo de programas de mejora productiva y conservación de esta raza autóctona cubana, ya sea *in situ* o *ex situ*.

Palabras clave: Bovino Criollo Cubano, marcadores moleculares

Introduction

It is considered of high-priority to increase the knowledge of different animal resources through inventories, characterization and estimations of productivity, adaptability to different environments, identification of resistance disease genes and/or improvement of production characters. Nowadays, it is possible to use a set of molecular tools that allows acceding to all the sites of the genome of the species at issue for the study of the different organisms, through genetic markers' detection that identify the individuals pertaining to the same population and as well, determine their variability [1].

The Cuban Creole bovine cattle is a product of a prolonged process of natural selection, partly empirically

directed, of the descendants of the cattle *Bos taurus* introduced by the Spanish conquerors and of animal coming from Africa via Jamaica, mainly *Bos indicus*. Their aptitudes as animals of triple intention are proven (shot, meat and milk production), their great adaptability to tropical climates and their high resistance to the infectious diseases, explain why its genome constitutes an invaluable source of information, useful for biodiversity studies, population characterization, association of genetic markers with productive characters, as well as processes of genetic evolution.

The necessity to develop efficient programs of genetic improvement in the Cuban Creole race is not explicitly clear, that's why the conservation aspects

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of its genetic material as genetic resource for the future have been emphasized. Although these premises are totally valid, this cattle can also fulfill the present goals of sustainable development in the production animal that demand an ample knowledge of those genotypes able to maintain a suitable behavior in difficult conditions.

The present study sustains the use of the molecular markers for the genetic characterization of the Cuban Creole bovine cattle through the typing of six milky proteins [2, 3], markers of random amplified polymorphic DNA [4], microsatellites *loci* [5], markers in the mtDNA and the Y chromosome [6].

Results

It was confirmed the presence of genes *Bos indicus* in the Cuban Creole cattle through the typing of milk proteins coding genes, that assumed pure *Bos taurus* by its European origin. Typical alleles of *Bos indicus* were identified in the genes that codify for α_{S1} -casein and α -lacto-albumin. This it is the result of years of uncontrolled mating of the descending animal of the introduced ones in the island at the Spanish colonization times, as much originating from Spain and Africa.

In addition, it is considered that this race displays genetic potential to be used in programs of genetic improvement, preferably directed to the improvement of the milk quality; this also is sustained by the high frequency of alleles of favorable milk proteins for this intention. There are specific band profiles for the breed in each of the random amplified polymorphic DNA markers used, with high content of polymorphic information, indicative of the high existing genetic variability in the Cuban Creole breed. It was also possible to establish, the genetic structure of the population through microsatellite marker, with new evidences of the high breed genetic variability and the identification of own unique alleles.

It was identified that the population of Cuban Creole bovines displays an intermediate profile of genetic mixture between both uniparental ends with haplotypic mtDNA composition, similar to other Creole and Mediterranean breeds. In addition, the molecular

variation found in the Y chromosome (BTY) markers demonstrates a recent male mediated process of Zebu introgression in Cuban Creole population, which is in agreement with the historical origin of this native breed.

The phylogenetic relationships of Cuban Creole cattle and other Cuban breeds with their possible Iberian ancestors were verified. It was demonstrated that the Cuban Creole cattle displays high genetic variability indexes, in spite of more than 200 years of operation in the island. The genetic characterization, using molecular markers, of indigenous breeds, such as Cuban Creole cattle, is useful and necessary information to define the conservation units and it is one of the previous recommended steps to design a conservation plan of these important reservoirs of genetic diversity for commercial domestic species [7].

Relevance of the study

It is possible to count on the molecular tools and methodologies for the characterization of different cattle species, with commercial and genetic interest. The first molecular characterization of Cuban genotype was obtained using almost the totality of the markers available for these goals. An important contribution to the knowledge of the genetic characteristics of the Creole cattle in Cuba was done, providing valuable information about its genetic variability as a starting point in the design and development of improvement programs of improvement for the increase of the productive indicators. The bases for the development of conservation programs of this Cuban native bovine breed were pointed out, *in situ* or *ex situ*.

Conclusions

The Cuban Creole cattle, with genes that indicate the influence of *Bos taurus* in its formation, displays a genetic potential to be used in programs of genetic improvement, preferably directed to the milk quality improvement, which is sustained by the high genetic variability that shows the population as well as the particular characteristics of the breed, in spite of more than 200 years of operation in the island.

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