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Genetic certification of the Iberian ham

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Abstract. Under current Spanish regulations, the pigs that provide the raw material for the preparation of the country's most appreciated meat-derived product, dry-cured Iberian ham, must be of a specific genetic composition. Only the Duroc breed is accepted for crossing with Iberian pigs, and a maximum of 50% of the Duroc genome is permitted in the animals used to make this ham. This study describes a set of statistical procedures for detecting the breed composition of Iberian ham via the use of multilocus genotypes obtained by the amplification of 25 microsatellite markers. The procedure proposed in this study has been used for several years routinely in our laboratory for various purposes such as to certificate the genetic composition of some Iberian registered trademark hams or to detect commercial fraud in the Iberian ham consumed in Spain.

Keywords. STR – Traceability – Individual assignment – Genetic admixture.

Certification génétique du jambon Ibérique

Résumé. *Les porcs qui produisent la matière première pour la préparation du jambon le plus populaire parmi les produits à base de viande de porc Ibérique doivent être d'une composition génétique spécifique selon la loi espagnole. Seule la race Duroc est acceptée pour le croisement avec le porc Ibérique, pour un maximum de 50% du génome, afin de produire ce jambon. Cette étude décrit un ensemble de procédures statistiques de détection de la composition génétique de la race porcine Ibérique à travers l'utilisation de génotypes multilocus obtenus par amplification de 25 marqueurs microsatellites. La procédure proposée dans la présente étude a été utilisée régulièrement pendant plusieurs années dans notre laboratoire à des fins diverses, comme la certification de la composition génétique de certaines marques de jambon Ibérique ou la détection des fraudes commerciales pour le jambon Ibérique consommé en Espagne.*

Mots-clés. *STR – Traçabilité individuelle – Brassage génétique.*

I – Introduction

The Iberian pig ham is one of the most important traditional food products of the Spanish culture. The added value of this breed was supported by the necessary conservation of the Mediterranean paddock, known as "dehesa".

Iberian ham quality is the result of the genetic composition, the animal feeding during the fattening and the artisan management, but to profite this traditional product we have to take into account important additional factors, as the marketing and commercialization.

We have developed a microsatellites based methodology to supervise the assignment of the individuals to the Iberian breed and its varieties, in order to support the conventional mechanism of supervising which is based on the intervention of a qualifier office that use the subjective observation of a morphological phenotype as criterion of assignment. Our methodology is based in the fitness of the genetic individual profile to population genetic profiles, previously defined in animals belonging to the breed herd book or admitted by the breeders association as integrated in the different varieties forming the Iberian breed group.

In the present paper we are showing a real experience using this methodology in the breed

traceability of the products commercialized by Maldonado S.L. enterprise. It could be as a useful model to the sector to protect the genetic patrimony of the Iberian ham at the consumer eyes, the credibility.

II – Materials and methods

Maldonado S.L. is a traditional enterprise which commercialize only high quality Iberian products. Its "star" product is the called "Albarragena Ham" which is a selection of 100 hams among the thousands produced by the enterprise. This ham has been recognized as one of the most expensive ham of the world by the mass media.

These hundred hams have a lot of special commercial treatments to ensure their differentiated quality, such as a series number stamped in a silver medal, a presentation in an exclusive appearance, etc. This product reaches in the market the prize of 1500 Euro by piece.

One additional proof to support the credibility of the product is the incorporation of a certificate with the probability of assignment to the Iberian breed (Figure 1), and a series number to ensure the genetic traceability of the piece.

DNA extraction was performed from ham samples using the Genomic DNA Purification Kit (Gentra Systems, Minnesota, USA). Samples were screened for 25 pig microsatellites selected from the 27 markers recommended by the FAO for pig biodiversity studies (FAO,1998). Technical procedures of genotyping were described in previous papers (Vega-Pla *et al*., 2003; Garcia *et al*., 2006). Probability of assignment of individual genetic were determined using the Bayesian algorithms proposed by Baudouin *et al*. (2004), using Geneclass2 software (Piry *et al*., 2004) for the calculations. This methodology developed in the context of the EU project Characterization of genetic variation in the European pig to facilitate the maintenance and exploitation of biodiversity (BIO4 CT98-0188, DG XII European Commission, 1998-2000). It gave us the opportunity to access to a wide base of samples from almost all the pig European resources.

III – Results and discussion

All people involved in the Iberian pig world desire to maintain the credibility on the Iberian ham. There is an interest by the most serious private enterprises, which demanded an objective certification of purity of their products. Our methodology gave successfully response to this demand. Figure 1 shows a scheme of the factorial analysis results, defining the genetic assignment of the Albarragena hams to the Iberian pig genetic profile.

Table 1 is showing an example of the assignment probability of a set of Albarragena hams. This table of results is sent to the enterprise, to support its internal management in regards the selection of animals and pieces; the following up of the donor farms, etc.

Today the Iberian pig is researched intensely, also with the most advanced markers such as SNPs (Padilla *et al*. 2010), but these methodologies, under our point of view are optimal for marker assisted selection, and in the future for genomic selection, but microsatellite typing will continue being the tool of election for all around genetic characterization, breed traceability, and genetic diversity studies in general.

The present paper demonstrated that a tool to ensure the breed traceability of the Iberian pig products, also ensures the credibility of the high quality products.

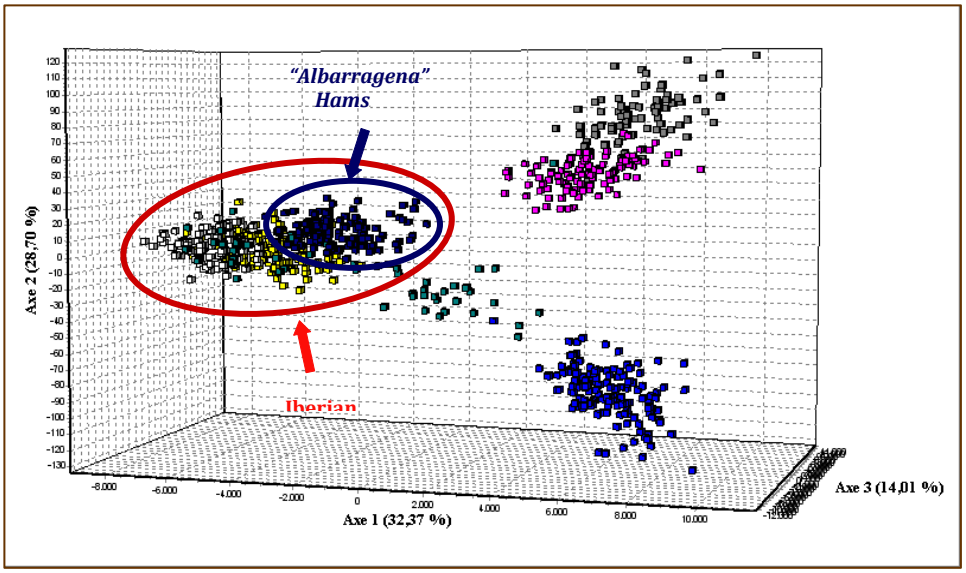

Fig. 1. Factorial analysis results, showing the inclusion of the Albarragena hams in the Iberian genetic profile.

Table 1. An example of the last Albarragena hams certified using the methodology of individual assignment to a population

Ham	P ASIG	Ham	P ASIG	Ham	P ASIG	Ham	P ASIG
0004393	0.983	0004893	0.991	0004839	0.986	0005087	0.992
0004663	0.944	0004878	0.993	0004454	0.988	0004217	0.991
0009386	0.990	0009287	0.923	0005626	0.984	0004010	0.987
0004842	0.991	0004362	0.969	0005118	0.990	0004369	0.967
0009550	0.991	0009435	0.985	0005047	0.993	0009378	0.992
0004344	0.940	0003560	0.969	0004455	0.981	0009392	0.974
0004970	0.989	0005235	0.990	0004329	0.951	0009321	0.990
0004461	0.984	0009454	0.978	0005233	0.987	0003618	0.991
0004871	0.992	0005050	0.984	0009343	0.979	0009445	0.994
0004509	0.972	0003557	0.967	0004951	0.990	0005245	0.993
0005025	0.985	0003930	0.992	0009335	0.961	0003621	0.986
0005259	0.988	0009295	0.949	0003568	0.994	0003492	0.994
0004478	0.984	0005169	0.984	0003652	0.983	0004861	0.993
0005241	0.977	0009437	0.966	0003573	0.973	0004034	0.905
0009545	0.990	0005044	0.996	0005052	0.985	0005084	0.986
0009460	0.956	0003707	0.987	0004915	0.994	0003623	0.966
0004375	0.962	0005177	0.994	0005035	0.990	0004095	0.994
0004920	0.987	0003939	0.992	0004504	0.981	0003650	0.954

IV – Conclusions

Today, Maldonado S.L. enterprise has enclosed in internal requirements of quality the use of the individual assessment bases on the genetic profiles obtained with a set of microsatellites, as

an objective method to ensure the breed traceability of their Iberian pig products. This common applications is an example to follow to maintain n the credibility of the consumers.

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