



Genetic diversity of Alentejano and Iberian breeds assessed by polymorphisms of major genes

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INTRODUCTION

Alentejano



Iberian



Mediterranean pig breeds located in the southwest of the Iberian Peninsula

Interchange of dams and sires

Border effect → Separation between breeds



INTRODUCTION



Common features

- Lower growth rate than other commercial breeds like Duroc or Landrace
- High fat deposition
- High-quality meat due to a higher intramuscular fat content
- High quality meat are the basis of their local products
- Extensive systems taking advantage of open range fields where the animals walk freely and are fed with acorns and grass



INTRODUCTION

Breeding strategies



Alentejano

Not frequently crossed with other breeds

Some crosses with Berkshire and Landrace since 1950's

Actively crossed with Duroc

Crossbred animals

↑ Average daily gain and lean percentage

Iberian



OBJECTIVE



Characterization of the genetic diversity of Alentejano and Iberian pig breeds using the genotyping data of variants located in 26 major genes

Variants genotyped



Alentejano, Iberian + 18 autochthonous breeds (Treasure)

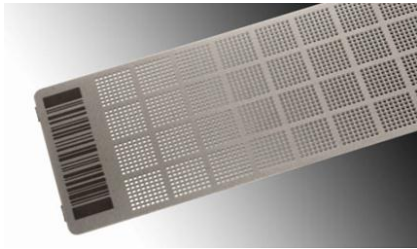


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GENOTYPING

- 32 genetic variants located on 26 major genes

MC1R, TYRP1, NR6A, PCK1, RYR1, IGF2, MC4R, LEPR, PHKG1, SCD, GBP5, TAS2R39, TAS2R4, TAS2R38, MUC4, ESR1, CYP2E1, LEP, CAST, MTTP, CYB5A, FTO, PPARGC1A, CAPN1, PPARD, CTSL



TaqMan® OpenArray®

- 48 Alentejano
- 48 Iberian
- 854 from 18 European breeds

Mangulica
Apulo
Casertano
Turopolje
Lietuvos višniškė
Black Majorcan
Mora Romagnola
Calabrese
Gascon
Ginta Senese
Krskop
Bisak
Black Slavonian



RESULTS

	Ho	Hs	Ht	Fis
MC1R*2 (G/A)	0.054	0.056	0.142	0.024
MC1R*3 (G/A)	0.126	0.127	0.345	0.003
MC1R*4 (C/T)	0.000	0.000	0.000	NA
MC1R*6_*7 (-CC-)	0.157	0.149	0.437	-0.060
TYRP1 (A/G)	0.024	0.025	0.028	0.038
NR6A1 (T/C)	0.132	0.129	0.161	-0.025
PCK1 (A/C)	0.330	0.343	0.492	0.037
RYR1 (A/C)	0.063	0.067	0.070	0.052
IGF2 (T/C)	0.185	0.200	0.285	0.076
MC4R (A/G)	0.321	0.306	0.419	-0.049
PHKG1 (C/A)	0.052	0.150	0.219	0.656
SCD (T/C)	0.228	0.218	0.298	-0.046
GBP5 (G/T)	0.237	0.241	0.287	0.017
TAS2R39 (A/C)	0.167	0.172	0.197	0.029
TAS2R38(A/T)	0.000	0.000	0.000	NA
MUC4 (C/G)	0.282	0.269	0.303	-0.048
ESR1 (G/A)	0.000	0.000	0.000	NA
CYP2E1 (C/T)	0.331	0.329	0.429	-0.007
LEP (C/T)	0.364	0.365	0.500	0.002
CAST (G/A)	0.295	0.389	0.489	0.241
MTTP (C/T)	0.414	0.415	0.488	0.003
CYB5A (G/T)	0.195	0.194	0.236	-0.005
FTO (A/T)	0.371	0.382	0.490	0.030
PPARGC1_Cys43	0.378	0.375	0.499	-0.009
CAPN1 (A/C)	0.378	0.382	0.491	0.013
PPARD (G32A)	0.074	0.079	0.085	0.061
CTSL (C/T)	0.000	0.000	0.000	NA

26 SNPs successfully genotyped

hierfstat (R environment)

Overall values

Ho Hs Ht Fst Fis
 0.19 0.20 0.27 0.27 0.04



27% of genetic variation due to differentiation among breeds



RESULTS

	Ho	Hs	Fis
Alentejano	0.130	0.139	0.052
Ibérico	0.140	0.154	0.078
Basque	0.095	0.107	0.074
Gascon	0.189	0.178	-0.055
Porc Negre	0.166	0.176	0.073
Lietuvos vietines	0.257	0.263	-0.002
Senojo	0.206	0.202	0.036
Bisaro	0.213	0.227	0.055
	0.193	0.200	0.027
Schwabisch Hallisches			
Mangulica	0.120	0.128	0.072
Mora Romagnola	0.163	0.156	-0.042
Nero Siciliano	0.233	0.259	0.074
Moravka	0.264	0.275	0.026
Krskopolje	0.252	0.245	-0.034
Casertana	0.172	0.204	0.167
Turopolje	0.143	0.125	-0.090
Crna Slavonska	0.241	0.223	-0.053
Cinta Senese	0.207	0.207	0.012
Sarda	0.247	0.284	0.116
Apulo Calabrese	0.191	0.219	0.098

17 SNPs segregating in Alentejano

19 SNPs segregating in Iberian

Low and similar Ho, Hs, Fis

Genetic Distances (Takezaki and Nei (1996))

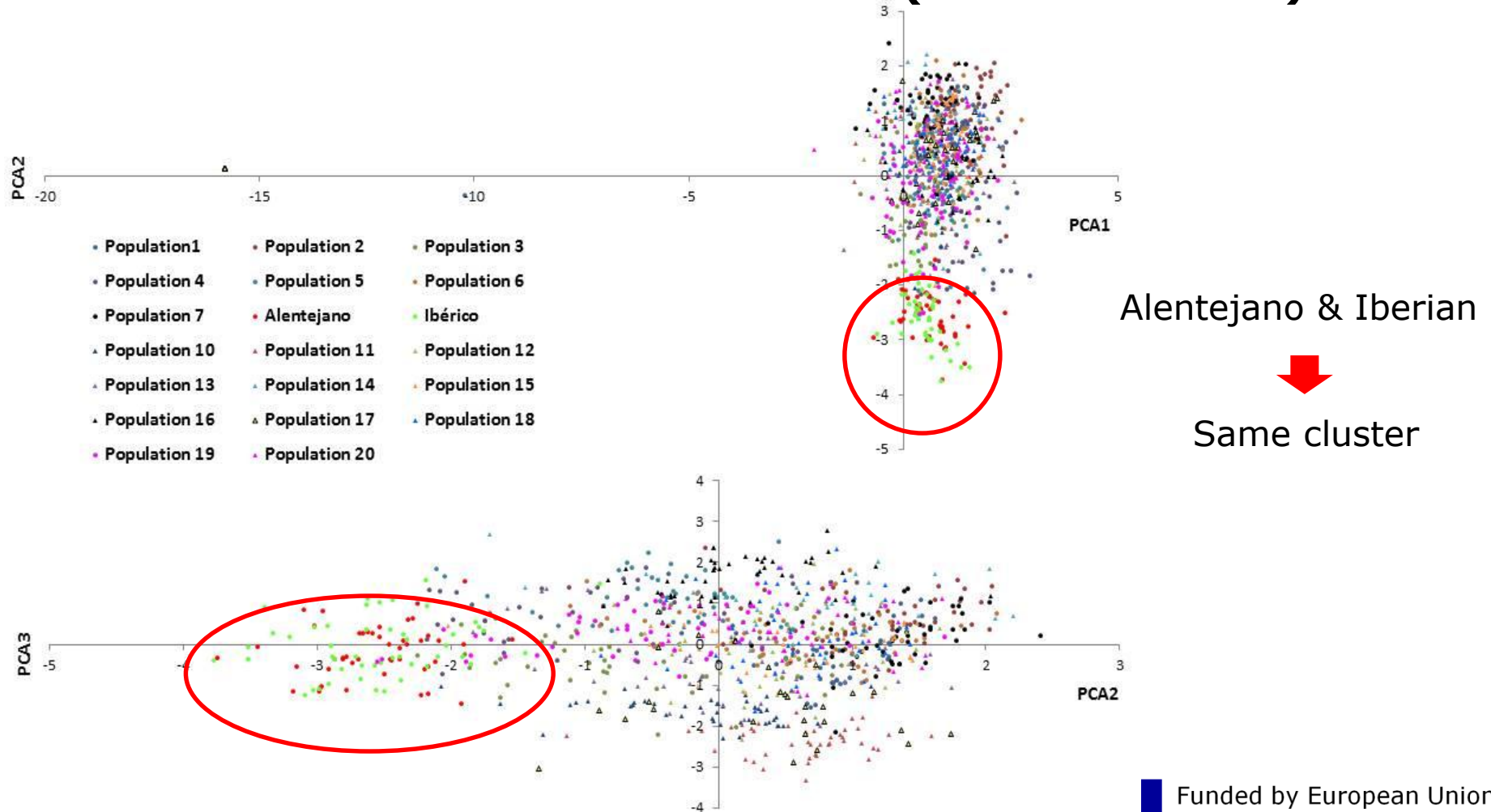
Ds: 0.005

F_{ST}: 0.030



RESULTS

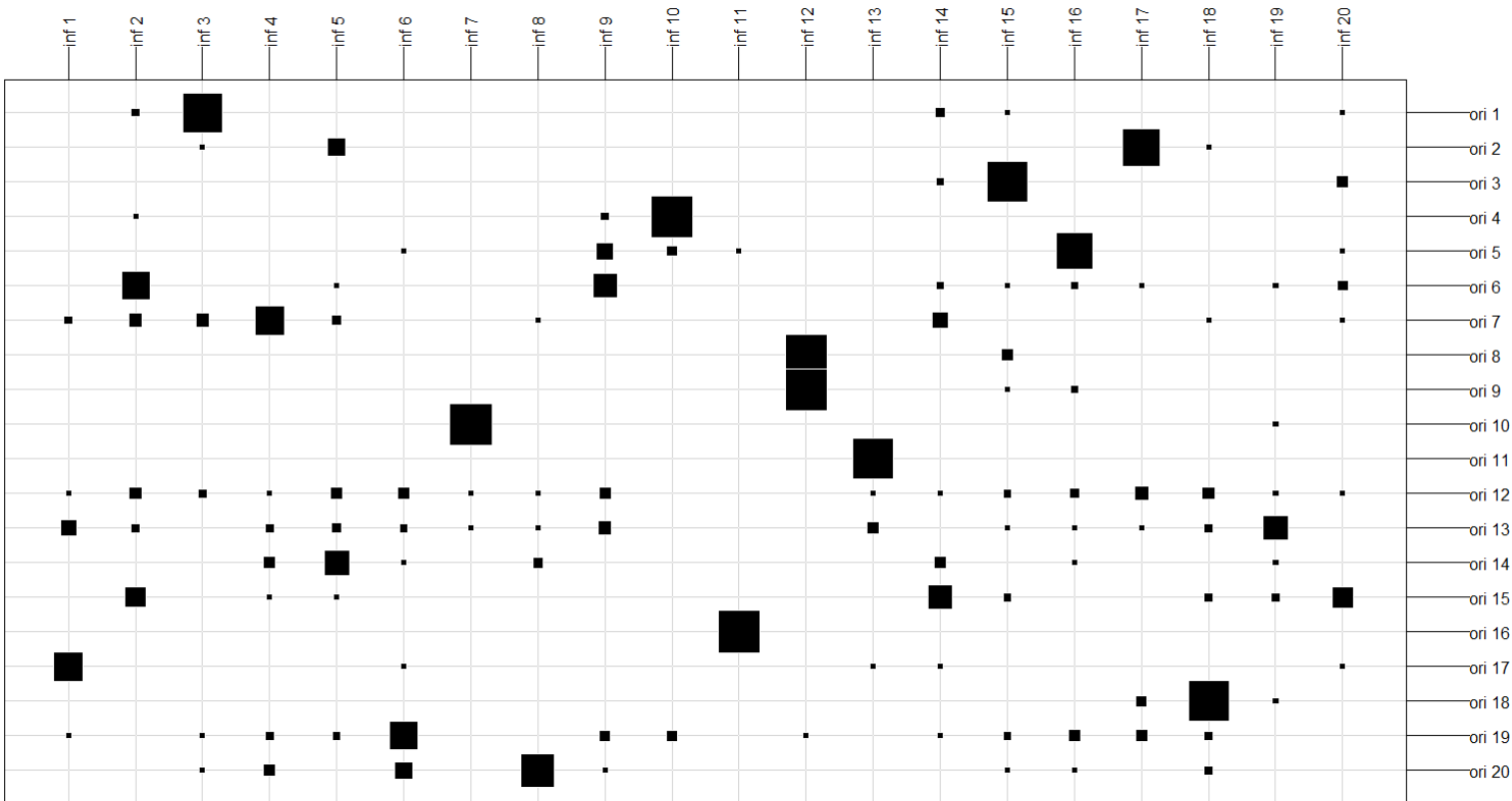
PRINCIPAL COMPONENT ANALYSES (FactoMineR in R)



RESULTS

Discriminant Analysis of Principal Component (DAPC)

Adegenet (R)



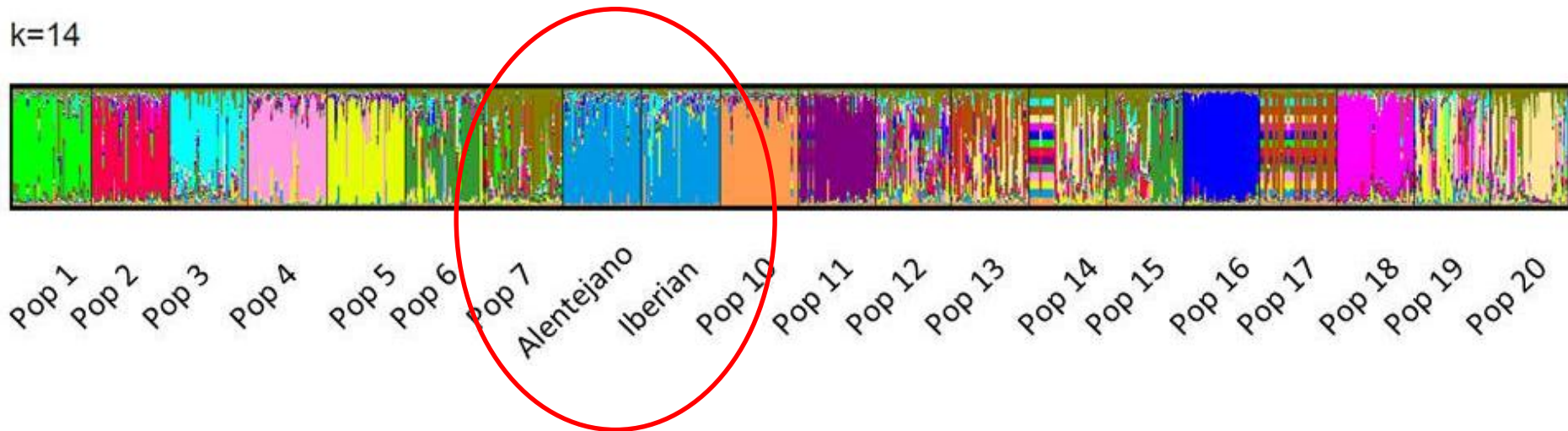
RESULTS

STRUCTURE

- Burning period: 50,000
- MCMC replications: 200,000; $2 \leq k \leq 25$ (k number of clusters)

Plateau in $k = 14$

k=14



Alentejano and Iberian show similar pattern



REMARKS

- Short genetic distances previously reported using mtDNA control region (Van Asch *et al.* (2012))



- High genetic similarity between Iberian & Alentejano for the analysed SNPs

- Additional analyses including {
 - SNPs in other candidate genes
 - 70k SNP chip (Illumina)





Diversity of local pig breeds and production systems for high quality traditional products and sustainable pork chains



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Thank you very much!