Marker assisted selection in Rasa Aragonesa sheep breed by using a SNP panel for parentage assignment

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iSAGE
Innovation for Sustainable
Sheep and Goat
Production in Europe

Introduction

- ✓ Autochthonous Mediterranean sheep breed

- ✓ Northeast of Spain

- ✓ Extensive or semi-extensive farming systems

- ✓ Meat production

- ✓ Reproductive seasonality

Great variation in lamb production and, in the market price of lamb meat

Improvement of farms efficiency is possible by nutrition, management approaches and **genetics**

Selection program for prolificacy and maternal capacity, including some genetic markers (**MAS**)

Introduction

Genetic Breeding Programs → Accurate EBV and genetic response → Accurate pedigree information

Very low proportion of known sires in Spanish meat sheep populations

↓

Development of a SNP assay for some North-Eastern Spanish meat sheep populations for accurate pedigree assignment
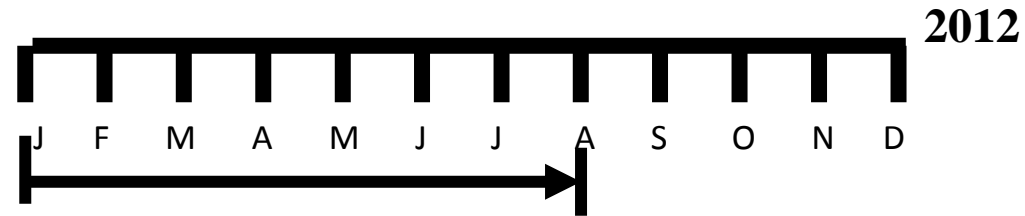
153 SNPs for parentage assignment

39 functional SNPs: prolificacy, seasonality, scrapie resistance, etc ...

Objectives

1. Selection of some new SNPs
for the SNP panel

2. Validation of some putative causal
SNPs using the SNP panel as
a proof of concept

Material & Methods

Experimental population

2012

J F M A M J J A S O N D

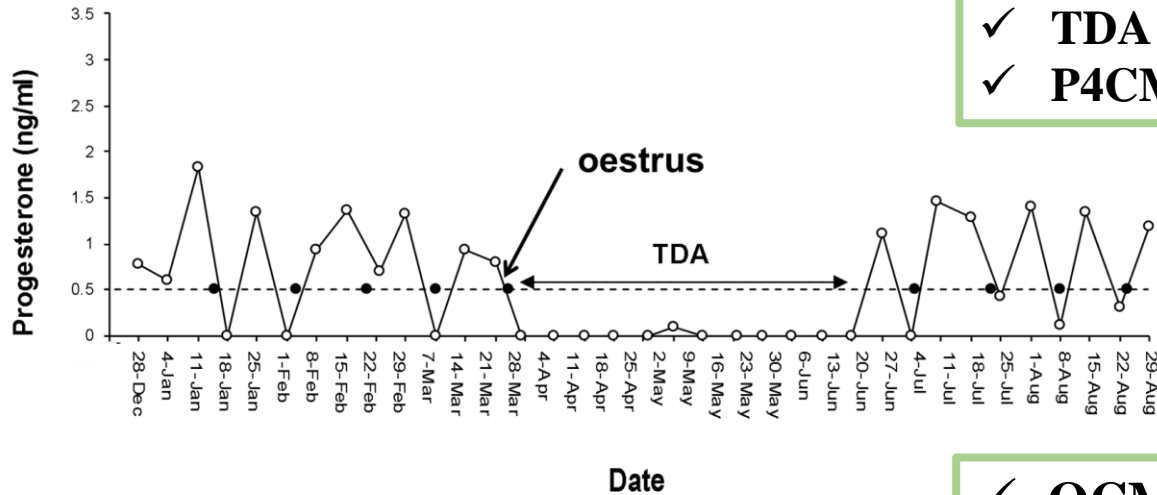239 Rasa Aragonesa adult ewes

young
(n=84; 1.9 y.)

mature
(n=155; 5.2-7.2 y.)

- BCS & LW/3 weeks

- Plasma progesterone Concentration/ week
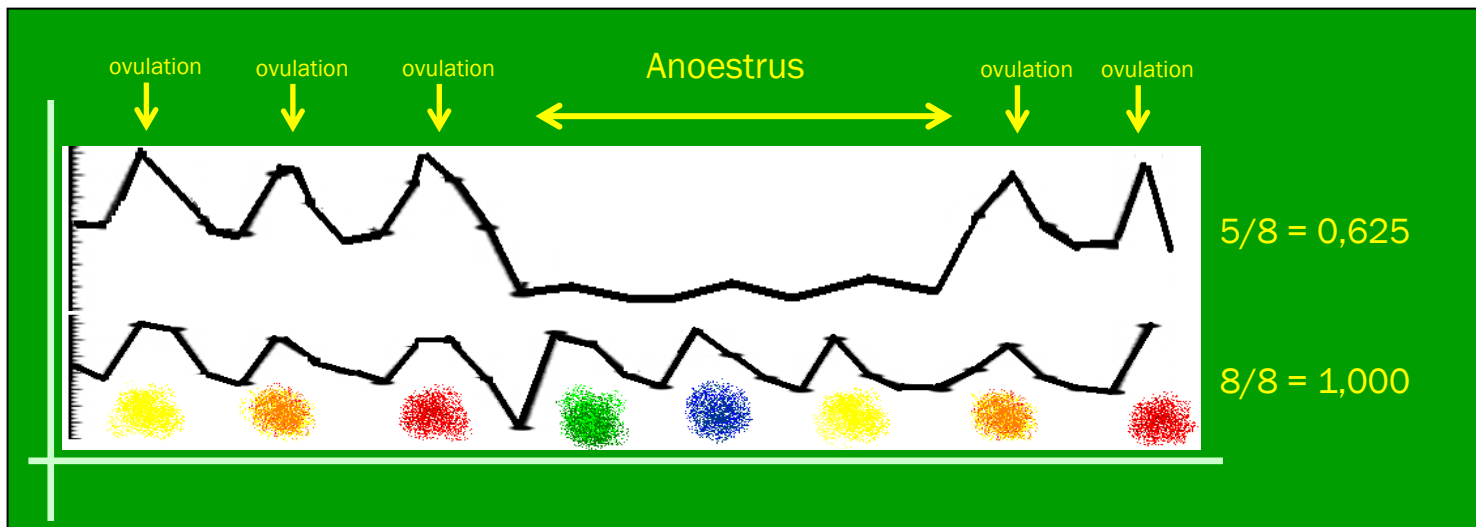
- Oestrus detection with vasectomised rams

Material & Methods

Phenotypes: Reproductive seasonality traits

✓ **TDA** : Total Days of Anoestrus
✓ **P4CM** : Progesterone Cycling Months

✓ **OCM** : Oestrus Cycling Months

5/8 = 0,625

8/8 = 1,000

Material & Methods

Is *Leptin receptor gene* (*LEPR*) affecting reproductive seasonality in Rasa Aragonesa?

✓ ***Sequencing to look for polymorphisms***: exon 4 (330 bp) and exon 20 (909 bp)

  (20 ewes with extreme phenotype for the TDA and OCM)

✓ ***Genotyping by KASP technology:***

➢ exon 4: rs411478947.

➢ exon 20: rs412929474, rs428867159, rs405459906

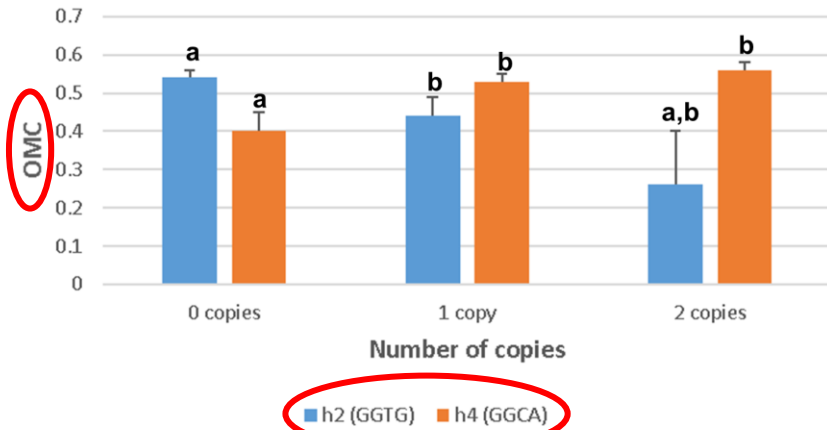✓ ***Haplotype (H) and SNP associations studies***: Mixed procedure of SAS

Trait= μ+Age+LW+BCS+SNP/H+ (SNP/H * age)
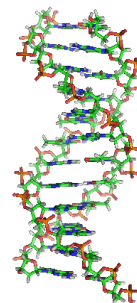
Results

LSmeans Haplotype effect

LSMeans Haplotype x age effect

LSMeans Haplotype x age effect

Material & Methods
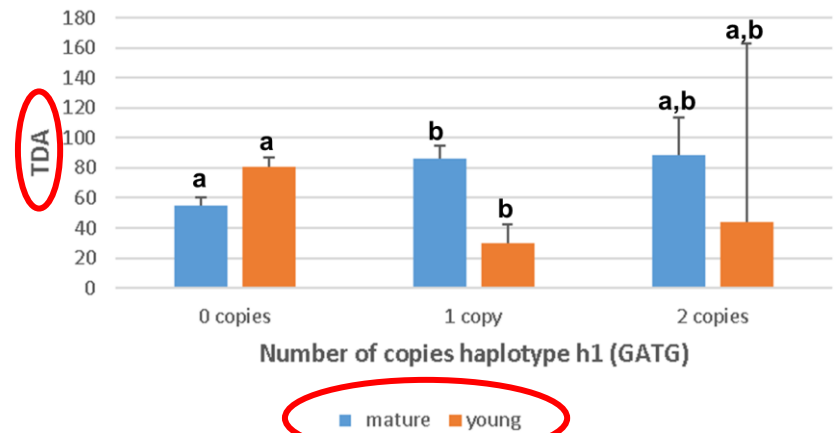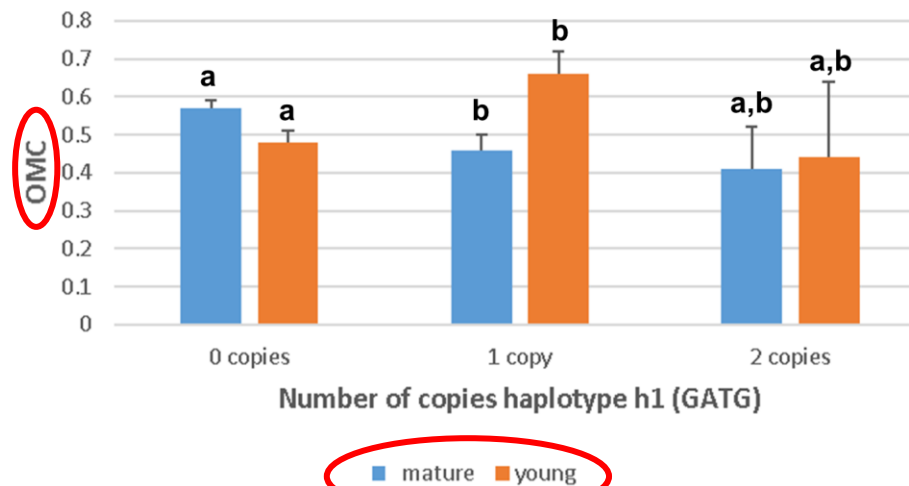
Proof of concept population

To identify new SNPs/genes associated with the AFL trait in sheep by using a SNP panel for parentage assignment
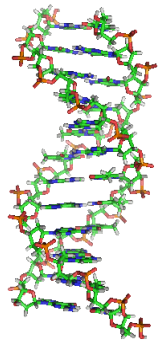

- ✓ Phenotype: 191,114 Age at First Lambing records from 327 farms
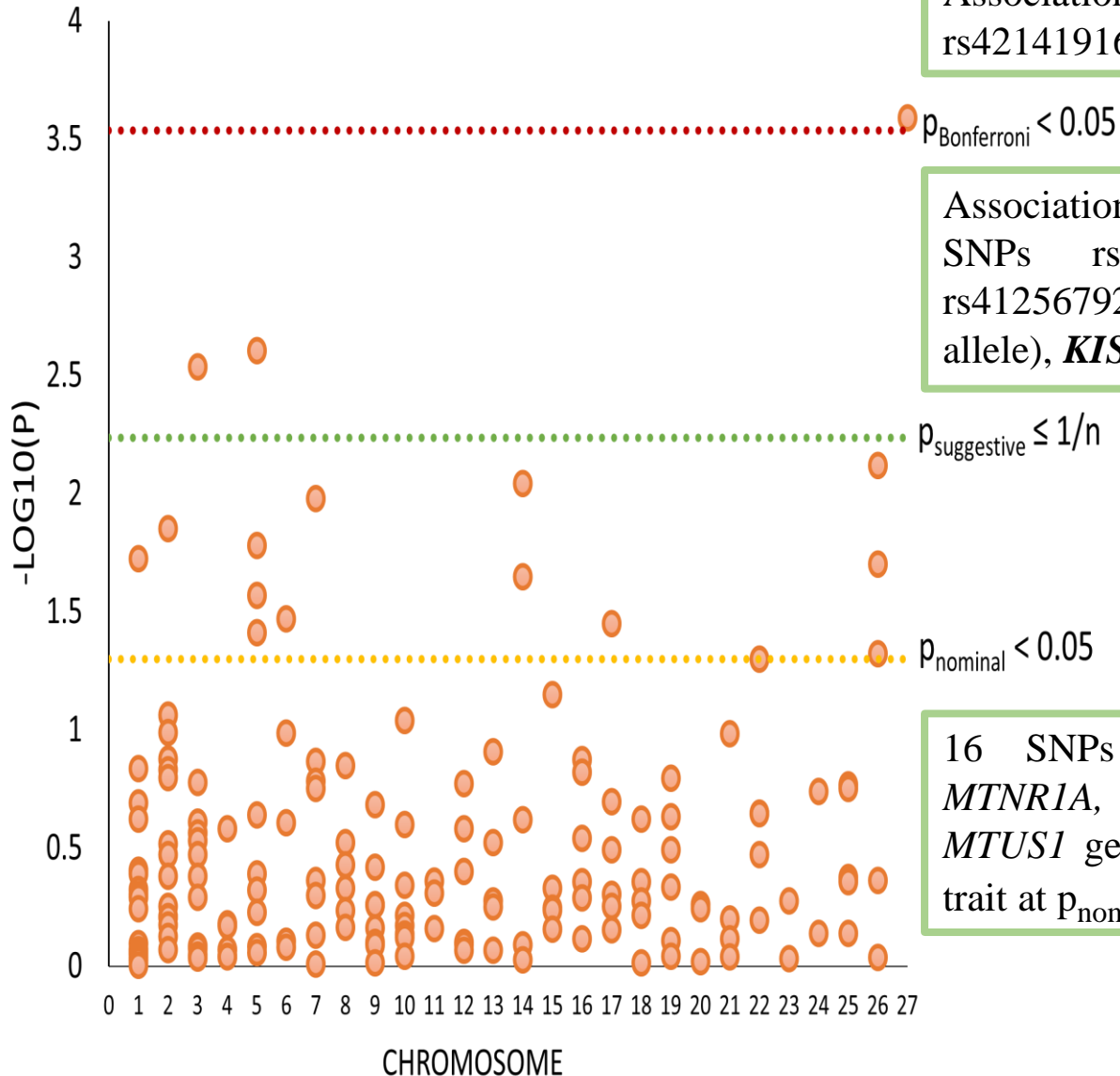
- ✓ Genotype: 3200 ewes , KASP technology

  153 SNPs for parentage assignment

  39 functional SNPs

- ✓ Association Analisis : GCTA software

Results

Associations at the genome level : SNP rs421419167(**BMP15/FecX^R allele**)

$p_{Bonferroni} < 0.05$

Associations at genome-wise suggestive: SNPs rs421419167, rs398938610 and rs412567923 located in *BMP15* (FecX^R allele), **KISS1R** and *SPTAN1* genes.

$p_{suggestive} \leq 1/n$

$p_{nominal} < 0.05$

16 SNPs located in *BMP15, KISS1R, MTNR1A, SPTAN1, FA2H, TMEM154* and *MTUS1* genes were found associated to AFL trait at $p_{nominal}$

Conclusions

❖ The usefulness of the SNP panel composed by 153 SNPs selected for parentage assignment, and 39 functional SNPs related to prolificacy, seasonality, scrapie resistance was confirmed

❖ The *LEPR* is associated to seasonality traits in Rasa Aragonesa including some of the *LEPR* SNPs in the SNP custom panel.

❖ The SNP panel could be useful for the breeding program as genetic markers to identify less seasonal or more prolific animals, and to design adequate decisions about its management in the selection program.

Thanks for your attention