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## A proposal for the Spanish horse breeds as a subpopulation within a European genomic metaanalysis

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- Long generation interval.
- Suboptimal selection intensities.
- Low heritable functional traits.



- Genomic Selection could be an advantage in horse breeding programs.



## Why Genomic Selection (GS)?

- **GS** allows selecting individuals in an early stage and for traits difficult to be measured.
- **GS** helps to increase the accuracy in the selection.
- **GS** maximizes the genetic progress in all livestock breeds.



## What about Genomic Wide Association (GWAS)?

- Lower annotation of the genome
- OMIA (2018): 57 mendelian traits
- Genomic variants with associations to performance:
  - MSTN (sprinting)
  - DMRT3 (trotting)
  - PDK4 (Racing)
  - ¿? ECA1 (jumping)



## What is the advantage of using a metapopulation?

### GS:

Improve the **PBV**s:

- in connected population
- when high linkage disequilibrium is present and the phase is common across populations

Correction of **IGxE**

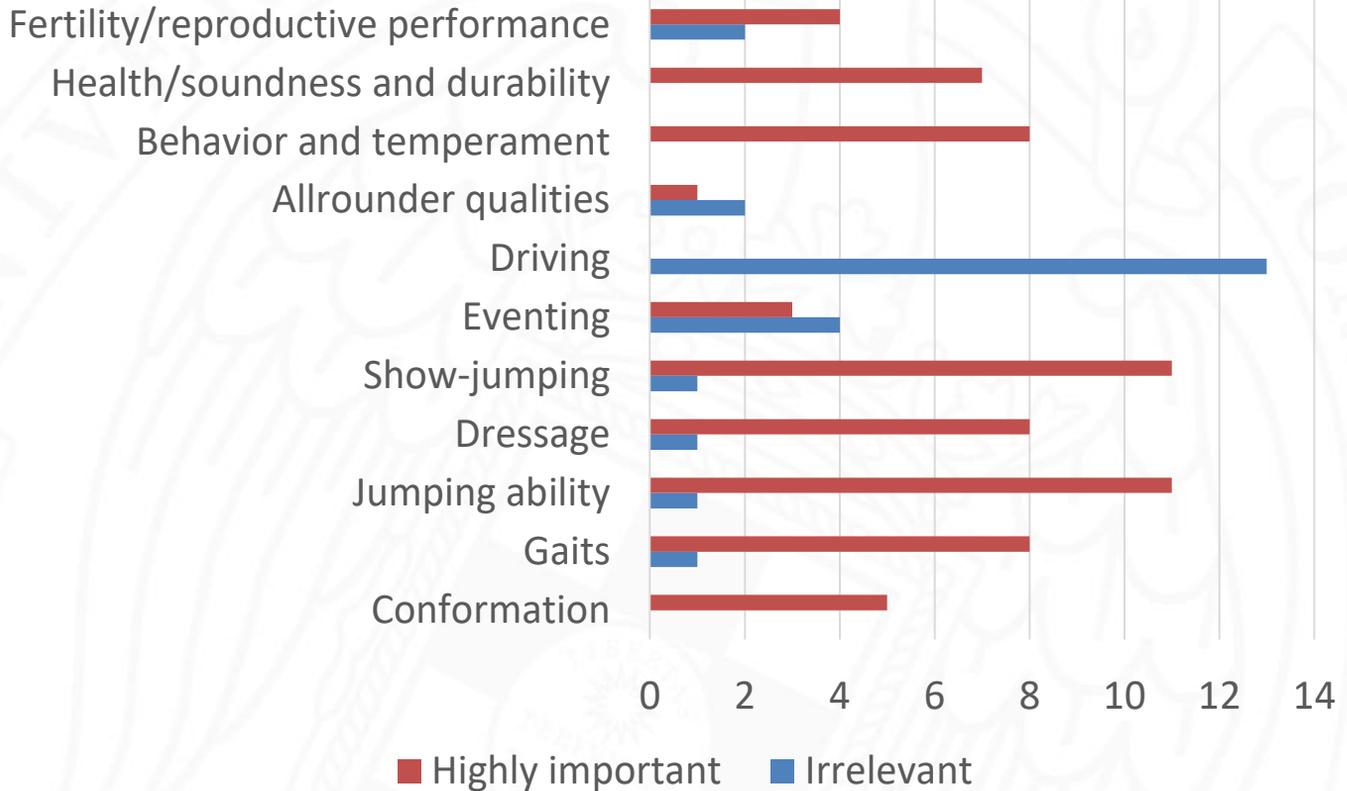
### GWAS:

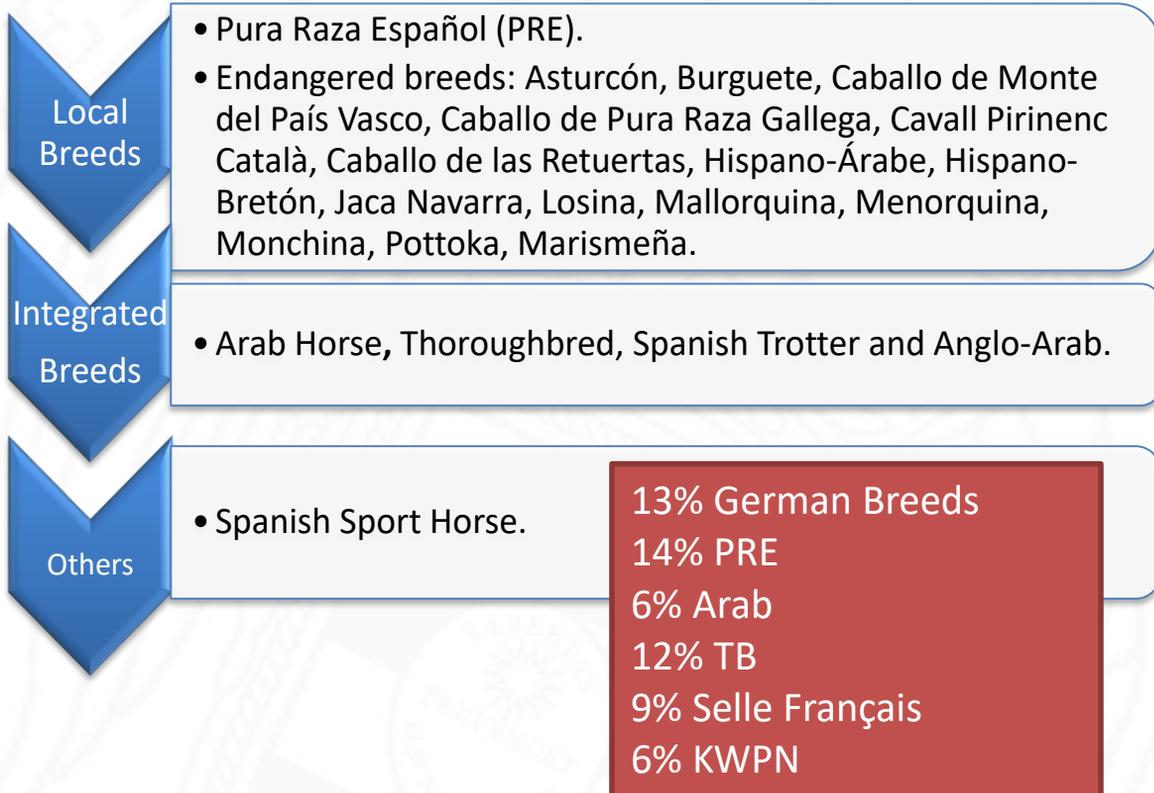
Improve the estimation of the **marker effect** in connected populations

**Validation** of markers related with a trait across populations

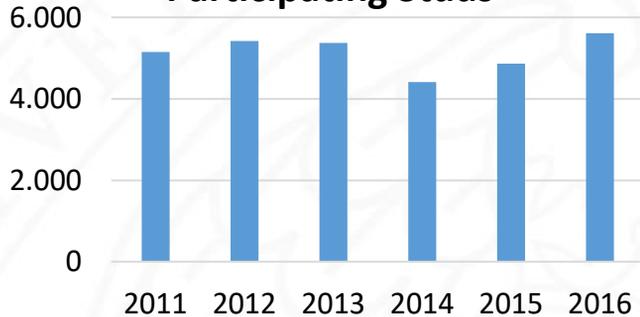
PBV: predicted breeding value

# SELECTION OBJECTIVES IN HORSE BREEDING

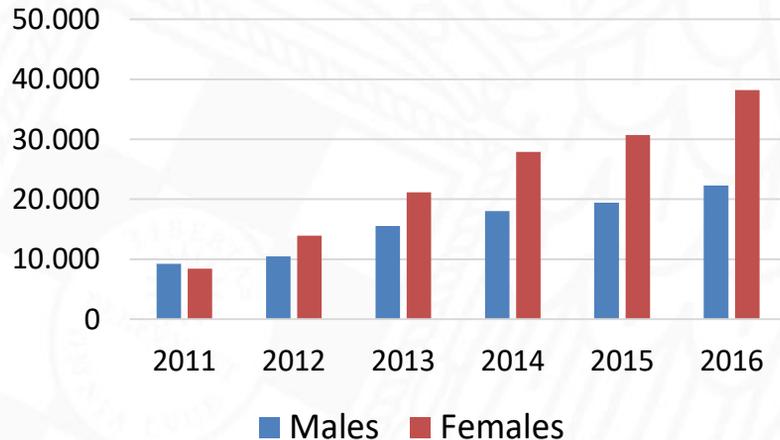




## Participating Studs



## Active animals with breeding value



## Numbers about gelding animals- Endurance Genetic Evaluation 2017-Example

- **Young Horses:** After genetic evaluation 100% of males that could obtain the young genetic category were geldings animals.
- **Horses >7 years old:** After genetic evaluation 60% of males with genetic index >100 and accuracy  $\geq 0.5$  were geldings animals.



1. Application of **genomic selection** to predict genomic breeding values comparing with the traditional ones.
2. Development of **genome wide association** analyses in performance and diseases traits.



## Performance datasets

Breed	Performance
Pura Raza Español (PRE)	dressage
Arab (A)	endurance
Anglo-Arab (AA)	show jumping, eventing, endurance
Spanish Trotter (STH)	trotting
Spanish Sport Horse (SSH)	dressage, show jumping, eventing
.....	.....

### Diseases:

Cresty neck  
Osteochondrosis  
Melanoma

.....

The **linear profiling** in PRE and A is also available

Joint Datasets	Records
Dressage	32 426
Show Jumping	207 187
Eventing	8331
Trotting	432 350
Endurance	6447

What about  
other  
populations?

**Pedigree: 3-9 equivalent complete generations**

## GENOTYPING

GeneSeek Genomic Profiler Equine Chip, GGP **80k**

High density Affymetrix **670k**



**IMPUTATION**

## SAMPLES

A total of **5750** individuals (1500 PRE,  
1500 SSH, 1000 A, 1000 STH and 750 AA).



**REFERENCE  
POPULATION**

## Genomic Breeding value prediction :

**Reference population:** one breed or a metapopulation

**Genetic models:** **GBLUP**  
Single-step  
Matrix  $H$  ( $G+A$ )

Bayes A, B, C,  $\pi$ , Lasso

Similar prediction ability  
Different size of samples

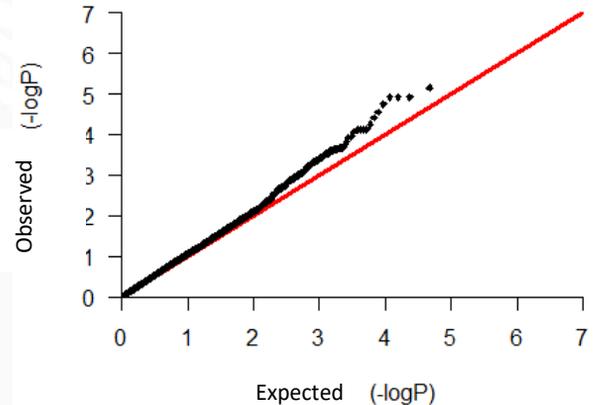
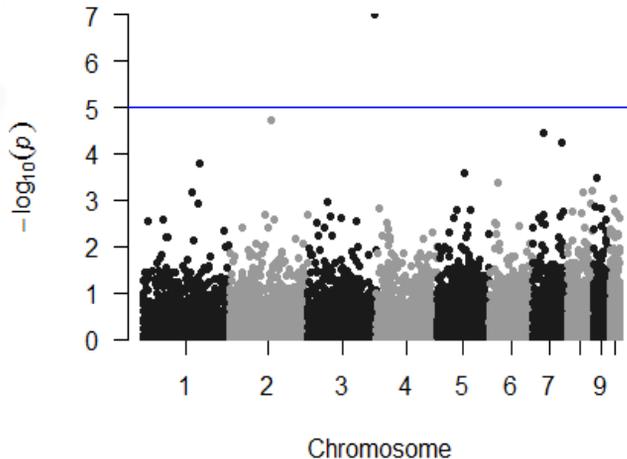


**Comparison with BLUP-pedigree**

## Genomic Wide Association

Sport Performance  
Linear profiling  
Diseases

100 kb window  
EquCab3.0



Ideas

partners

proposals

Get fundings!

**ERC sinergy grants**

**Contact:** [icervantes@vet.ucm.es](mailto:icervantes@vet.ucm.es)



Thank you



**Contact:** [icervantes@vet.ucm.es](mailto:icervantes@vet.ucm.es)