



TARANTO · MATERA · POTENZA · COSENZA · 9-12 LUGLIO 2009

# RELATIONSHIPS OF PODOLIC CATTLE BREEDS ASSESSED BY SINGLE NUCLEOTIDE POLYMORPHISMS (SNPs) GENOTYPING

L. Pariset<sup>1</sup>, M. Mariotti<sup>1</sup>, A. Nardone<sup>1</sup>, M.I. Soysal<sup>2</sup>, E.Ozkan <sup>2</sup>, J.L. Williams<sup>3</sup>, S. Dunner<sup>4</sup>, H. Leveziel<sup>5</sup>, A. Maroti-Agots<sup>6</sup>, I. Bodò<sup>6</sup>, F. Filippini<sup>7</sup>, A. Valentini<sup>1</sup>

<sup>1</sup>*Dipartimento di Produzioni Animali, Università degli Studi della Tuscia, Viterbo, Italy*

<sup>2</sup>*Namık Kemal University, Agriculture Faculty of Tekirdag, Department of Animal Science, Tekirdag, Turkiye*

<sup>3</sup>*Parco Tecnologico Padano, Via Einstein, Polo Universitario, Lodi, Italy*

<sup>4</sup>*Departamento de Producción Animal, Facultad de Veterinaria, Universidad Complutense, Madrid, Spain*

<sup>5</sup>*Unité de Génétique Moléculaire Animale, INRA/Université de Limoges, Faculté des Sciences et Techniques, Limoges Cedex, France*

<sup>6</sup>*SZIE Faculty of Veterinary Sciences, Hungary*

<sup>7</sup>*ANABIC – Via Viscioloisa, 06070 S. Martino in Colle, Perugia, Italy*



# SULLE TRACCE DELLE PODOLICHE

ON THE TRACKS OF PODOLIC GREY CATTLE

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# RELAZIONI TRA RAZZE BOVINE PODOLICHE VALUTATE CON SINGLE NUCLEOTIDE POLYMORPHISMS (SNPS)

L. Pariset<sup>1</sup>, M. Mariotti<sup>1</sup>, A. Nardone<sup>1</sup>, M.I. Soysal<sup>2</sup>, E.Ozkan<sup>2</sup>, J.L. Williams<sup>3</sup>, S. Dunner<sup>4</sup>, H. Leveziel<sup>5</sup>, A. Maroti-Agots<sup>6</sup>, I. Bodò<sup>6</sup>, F. Filippini<sup>7</sup>, A. Valentini<sup>1</sup>

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<sup>7</sup>*ANABIC – Via Visciolosa, 06070 S. Martino in Colle, Perugia, Italy*

- ◆ Hungarian Grey
- ◆ Maremmana
- ◆ Turkish Grey

same podolic group of cattle  
similar external conformation  
recently underwent a similar  
demographic reduction



**M  
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r  
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m  
m  
a  
n  
a**



- Existence of long horned cattle in Latium reported since Roman times (ancestors of the Maremmana?). Maremmana may be found to trace back to Grey Steppe cattle which entered Italy in large numbers during the 14th to 18th centuries.
- Herdbook registration started in 1935 (total breed population 274,000 head).
- During the 1930s and 40s exported to Hungary to improve the Hungarian Grey.
- Since 1945 head numbers have declined dramatically, due to land reform and mechanization, and by the mid 1960s extinction was predicted.
- Breed recovered in 1965-75 for its ability adapt to the environmental constraints of the hilly areas of the Maremma, reaching 60,000 head in 1975.
- In 1992 the total was estimated at 10,000, of which 4,000 females and 120 sires were herdbook registered.

# *H u n g a r i a n G r e y*



# Theories on breed origin

- imported by the Hungarian conquerors in the 9th century from the Podolic area
- came from the South, because there is an evidence of the presence of similar cattle in Egypt and Italy
- domestication of the wild cattle (Aurochs) in the Carpathian basin

# Turkey Grey (Boz Step or Plevne)



# Turkish Grey

- ◆ Found in north western Turkey, this breed is a tri-purpose breed: kept for milk and meat as well as being used as a work animal. The breed came from the Grey Steppe type and originated from the Iskar breed of Bulgaria (Mason 1996). It is believed that Hungarian Grey cattle are the ancestor or relatives

# How much Grey breeds are related?



# Controls

- ◆ Marchigiana
- ◆ Piemontese

} Italian meat breeds subjected to different selection histories



# SNPs genotyping

- ◆ Approximately 100 single nucleotide polymorphisms (SNPs) in genes candidate for meat traits (from Gemqual EU project) were genotyped on individuals belonging to the 5 breeds.

# F-statistics

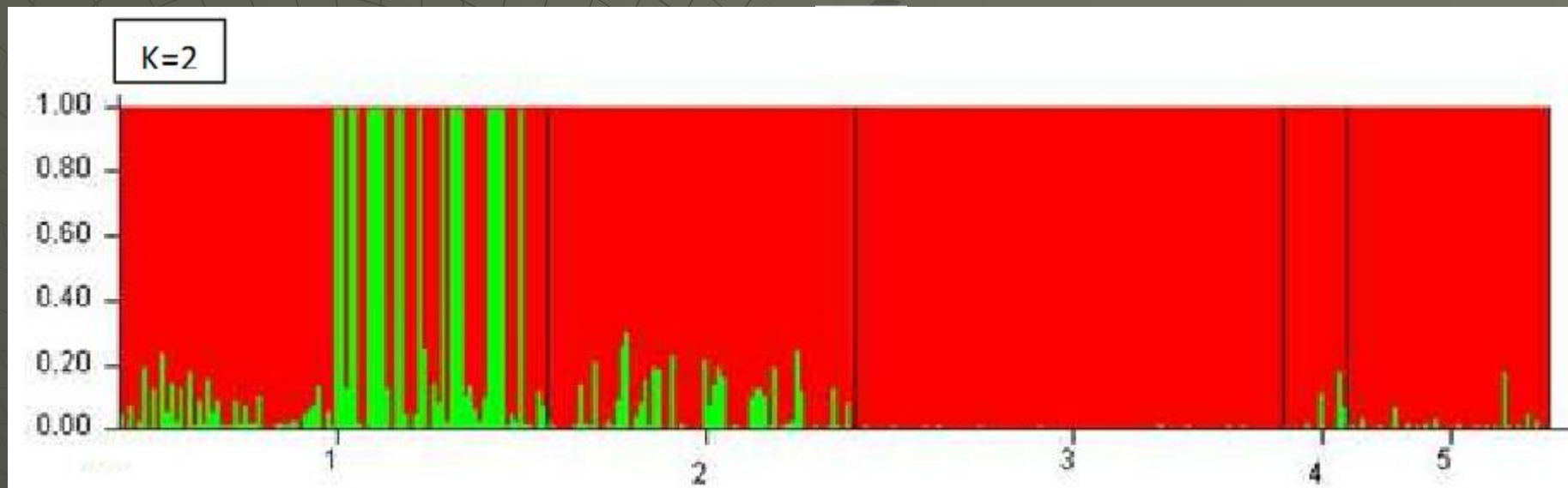
Sample	$F_{ST}$	$F_{IS}$
TG	0.2864	0.2088
HG	0.3213	-0.0500
MM	0.3345	-0.0681
MR	0.2771	0.1213
PD	0.3297	-0.0161

# Structure output (Pritchard 2000)

## K=2

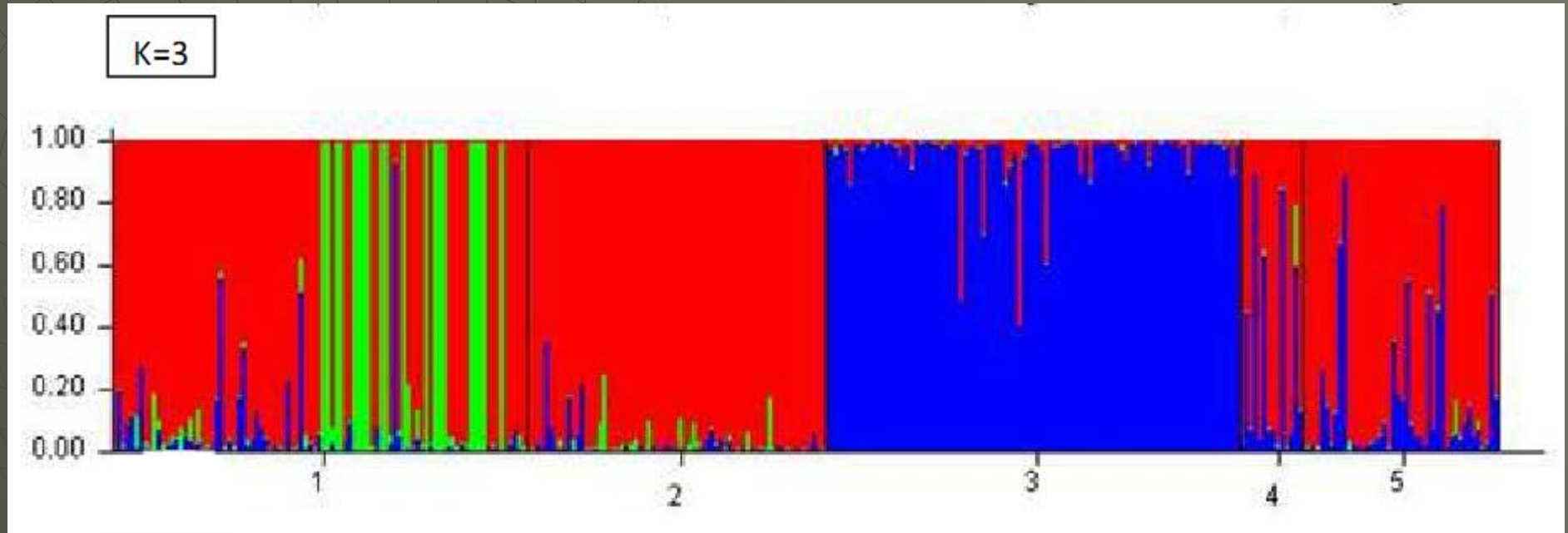
100000 burning in  
200000 MCMC

**admixture model**



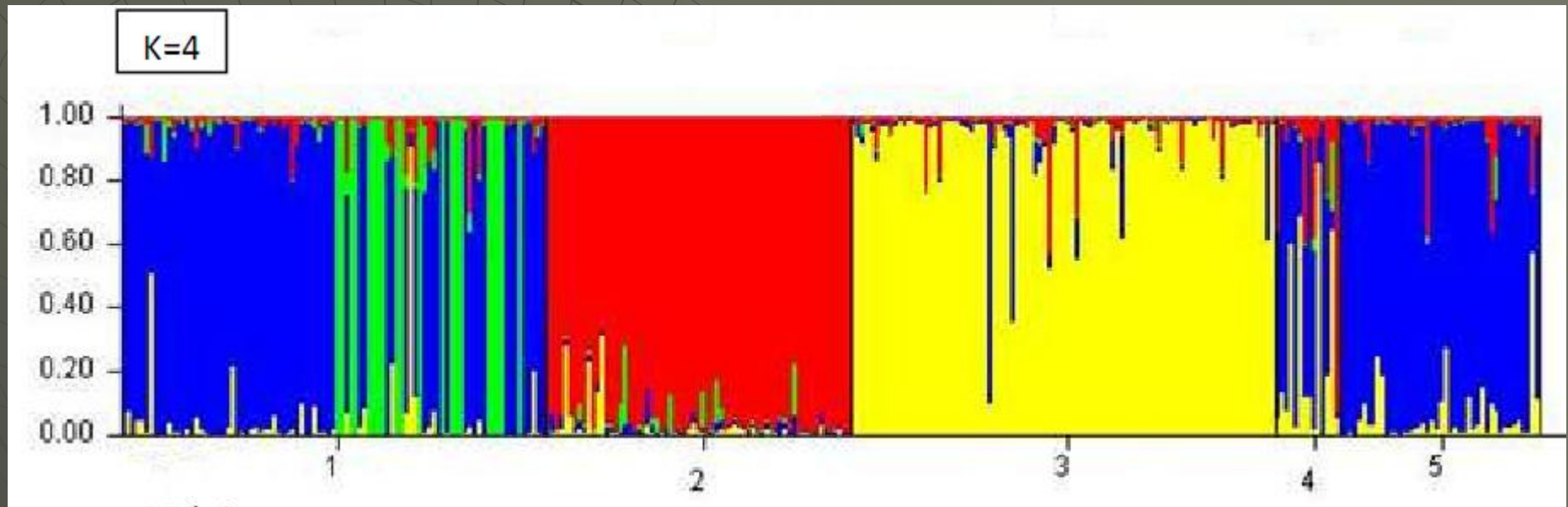
Turk.G.	Hun. G.	marem	marc	piem
1	2	3	4	5

# K=3



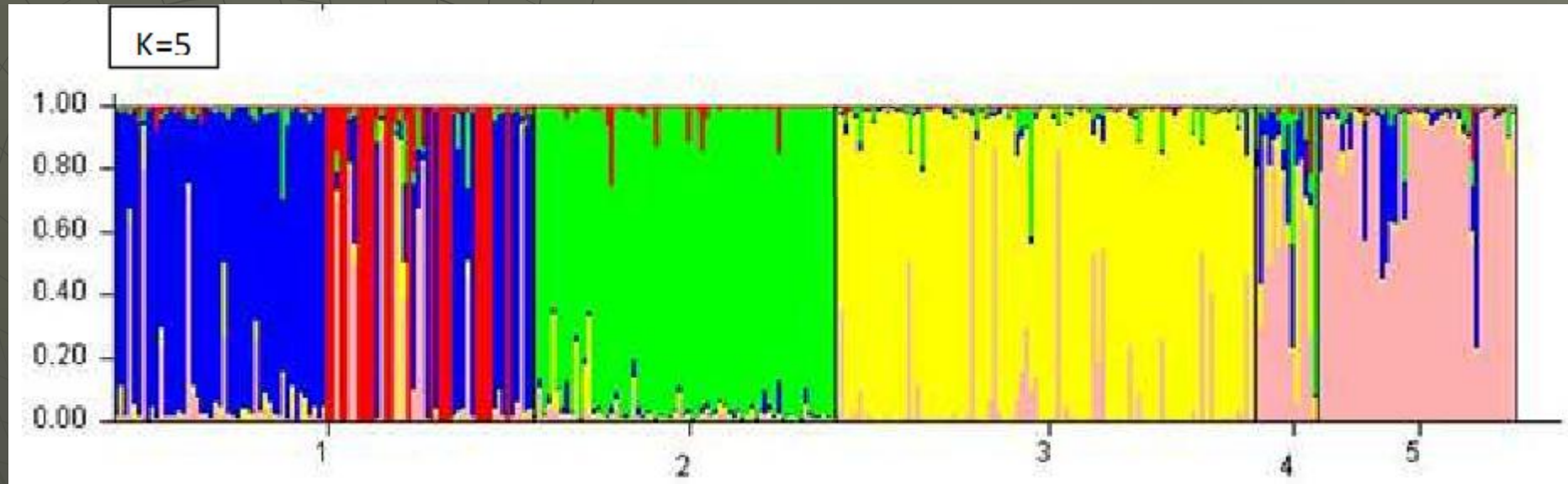
Turk.G.	Hun. G.	marem	marc	piem
1	2	3	4	5

# K=4



Turk.G.	Hun. G.	marem	marc	piem
1	2	3	4	5

# K=5



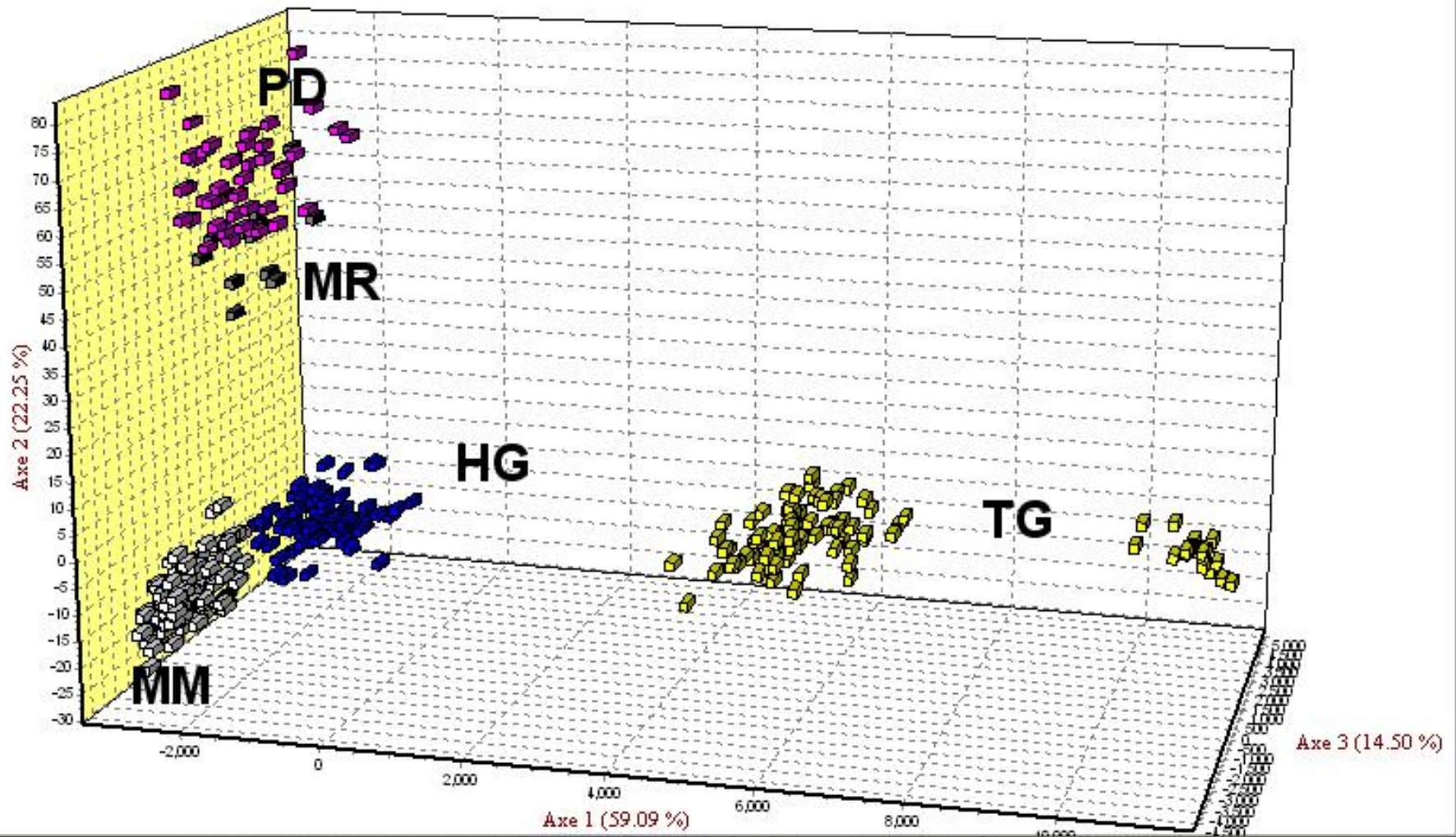
Turk.G.	Hun. G.	marem	marc	piem
1	2	3	4	5

# Attribution of individuals to the breeds

<i>Pre-defined Populations</i>	<i>Inferred Clusters</i>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>GS</b>	<b>0.599</b>	0.029	0.122	0.227	0.023
<b>HG</b>	0.016	0.024	0.017	0.017	<b>0.926</b>
<b>MM</b>	0.013	<b>0.863</b>	0.096	0.003	0.025
<b>MR</b>	0.148	0.159	<b>0.535</b>	0.021	0.138
<b>PD</b>	0.098	0.019	<b>0.853</b>	0.008	0.022

# PCA

Breeds\_fstat.gtx



# Conclusion I



Podolic cattle, despite their similar morphology, are genetically distinct breeds. This could be due either to a different origin of the breeds or to the consequences of the recent history, that led to the selection and probably fixation of genes.

# Conclusion II



Ample genetic diversity exists within breeds that could allow selection without increasing inbreeding

# Thanks for your attention

