Evolution of the genomic relationship between a local breed and its mainstream sister breed

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Ministère de l'Agriculture, de la Viticulture
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Administration des services techniques
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Introduction

- In Europe, a lot of red-pied cattle breeds
- Mainstream *vs.* endangered

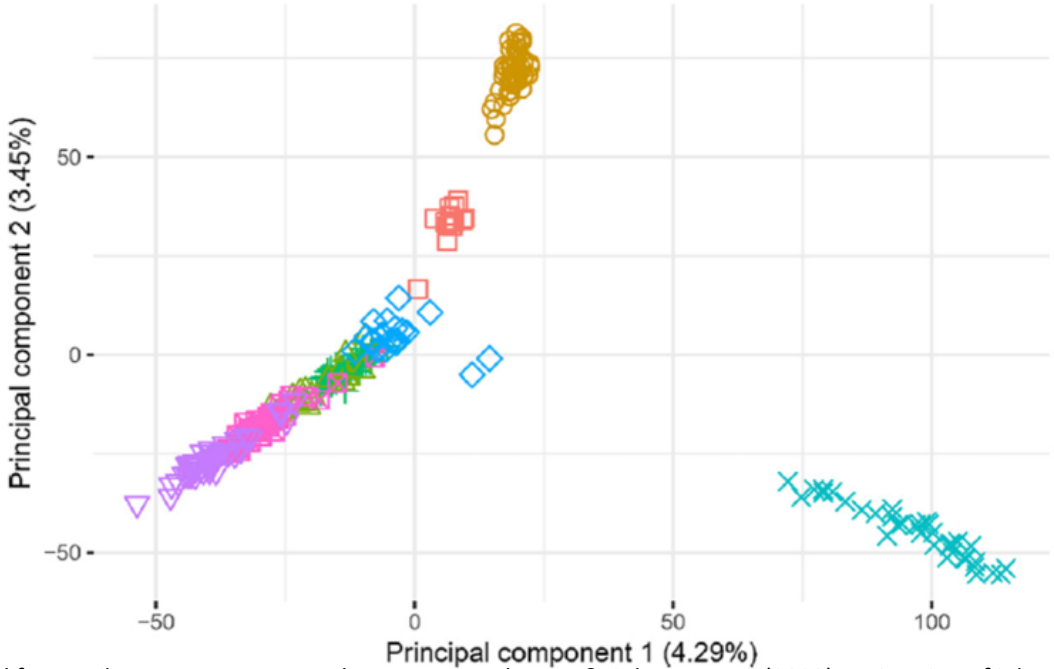
Meuse-Rhine-Yssel (MRY): ~ 15,000 animals

Red-Pied of the Ösling (RPO): 89 animals

Photo credit : Veeteelt (MRY) and Jeanne Bormann (RPO)

Introduction

- Proximity of both breeds on a PCA



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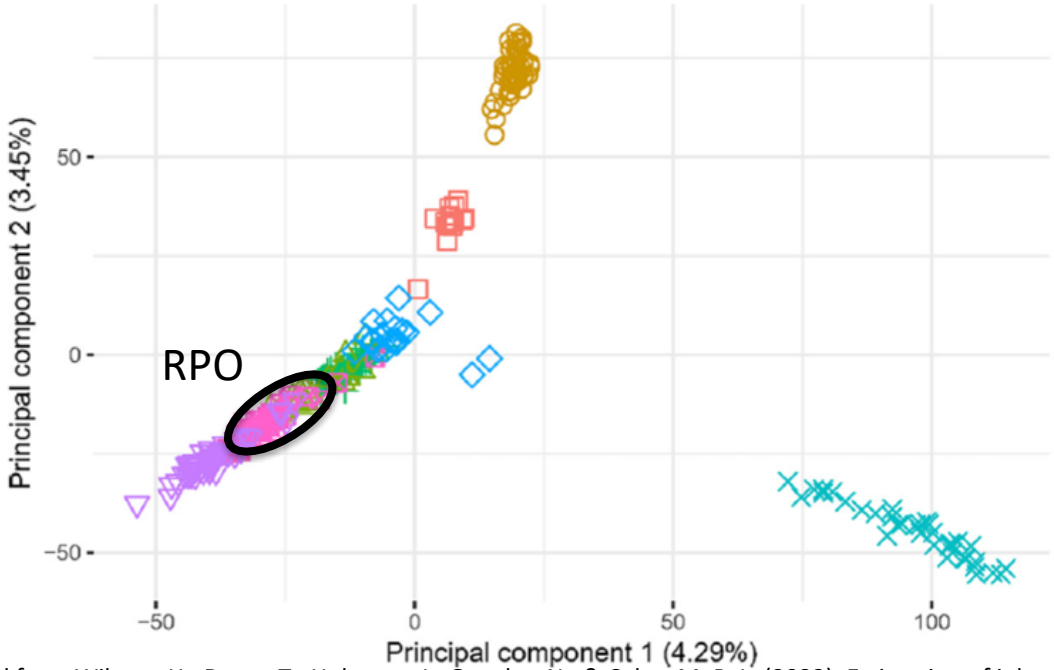

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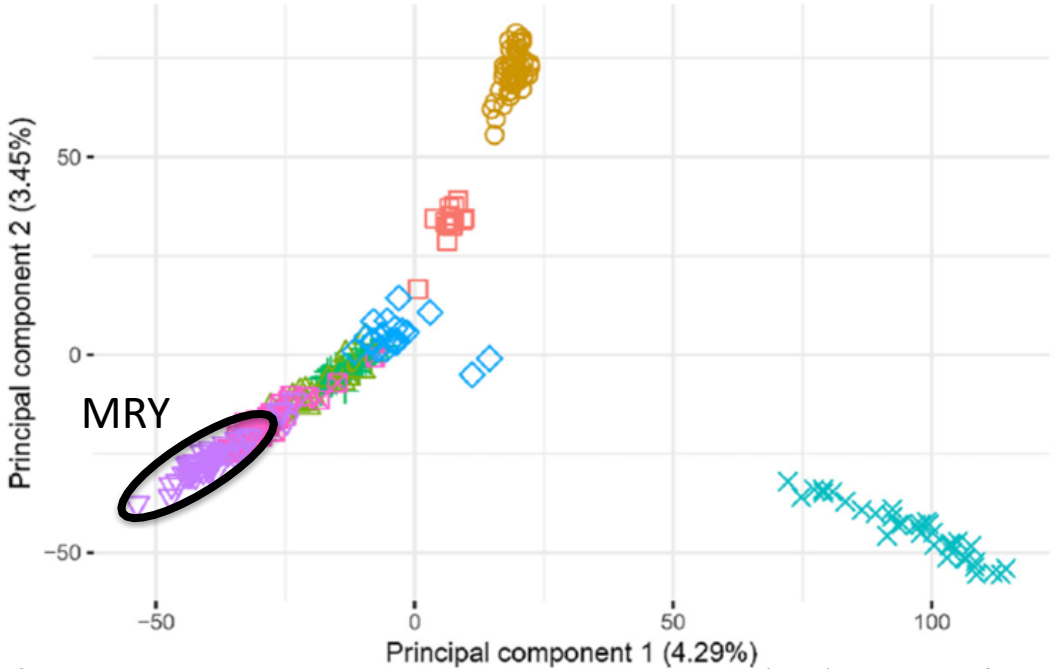

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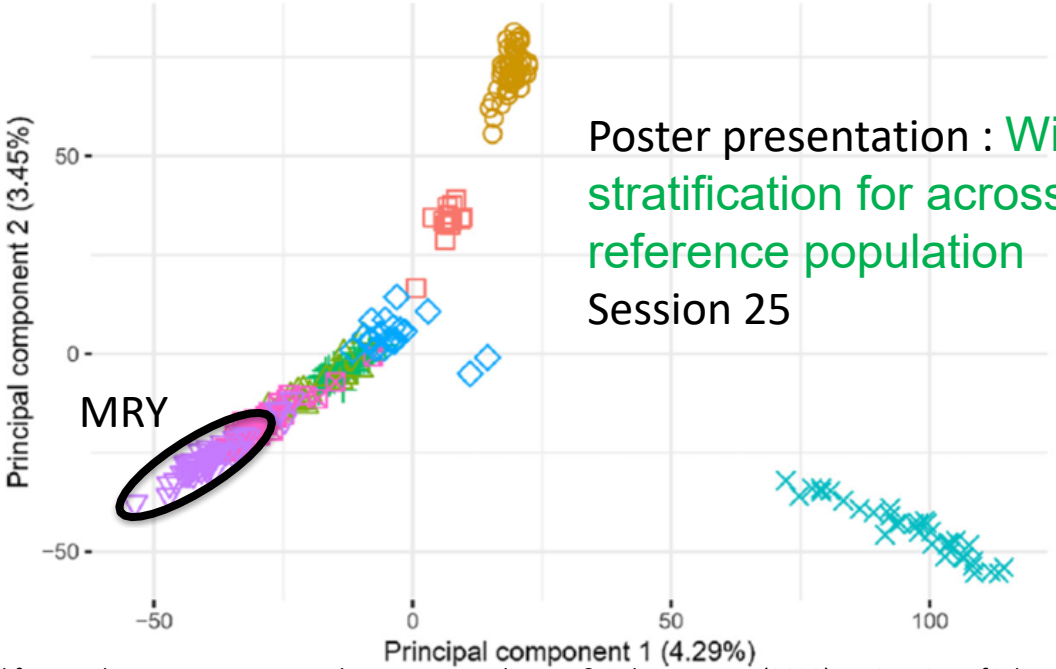
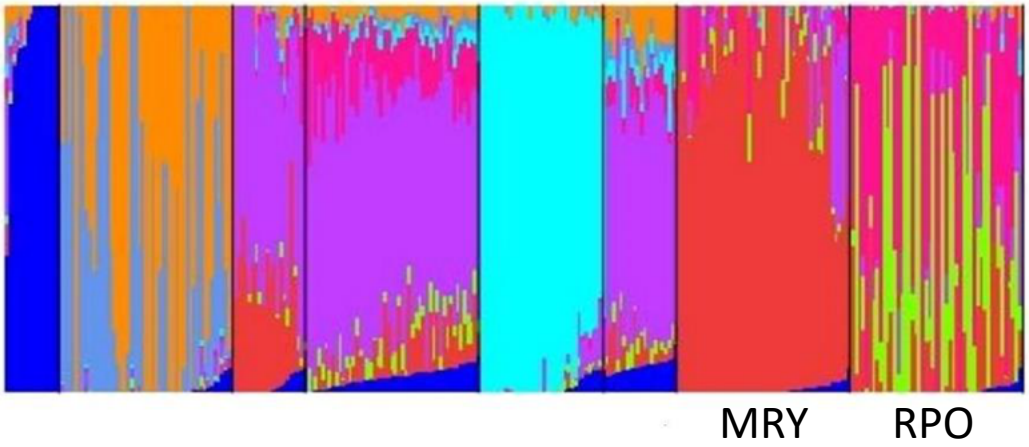


Poster presentation : Within-breed stratification for across-breed reference population
Session 25

Adapted from Wilmot, H., Druet, T., Hulsegge, I., Gengler, N., & Calus, M. P. L. (2023). Estimation of inbreeding, between-breed genomic relatedness and definition of sub-populations in red-pied cattle breeds. Animal, 17 (5), 100793. doi:10.1016/j.animal.2023.100793

Introduction

- Introgression of MRY in RPO ?



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Objective

- To investigate the evolution of the genomic relationship between MRY and RPO

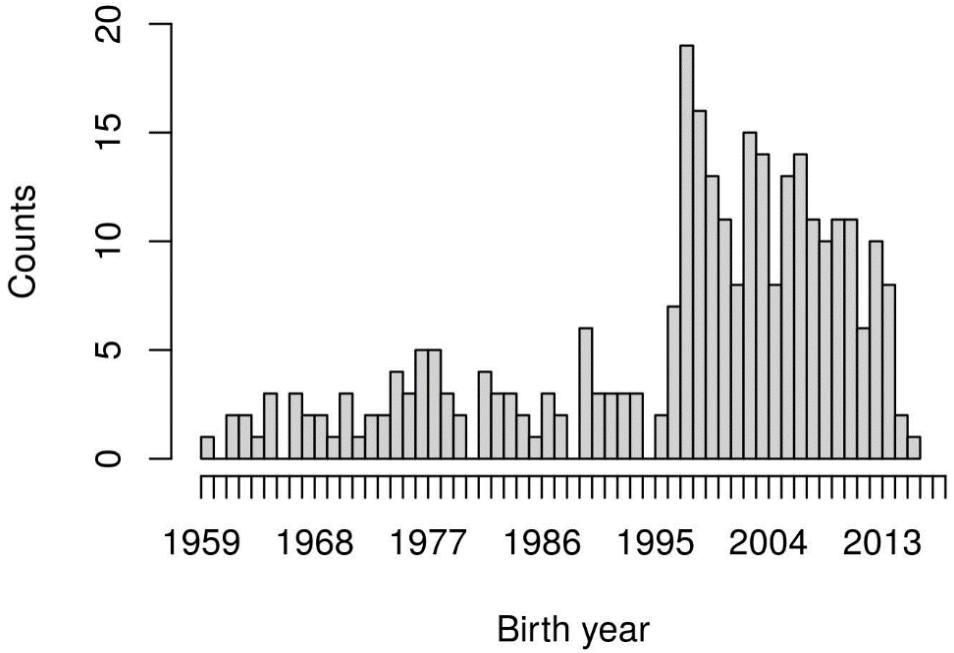
Data

- RPO genotypes (n = 132)
- MRY genotypes (n = 292)
- 39,967 SNPs

Definition of MRY cohorts

Cohort	Born	n
MRY1	Before 1990	64
MRY2	1990 - 1999	62
MRY3	2000 - 2009	117
MRY4	After 2009	49

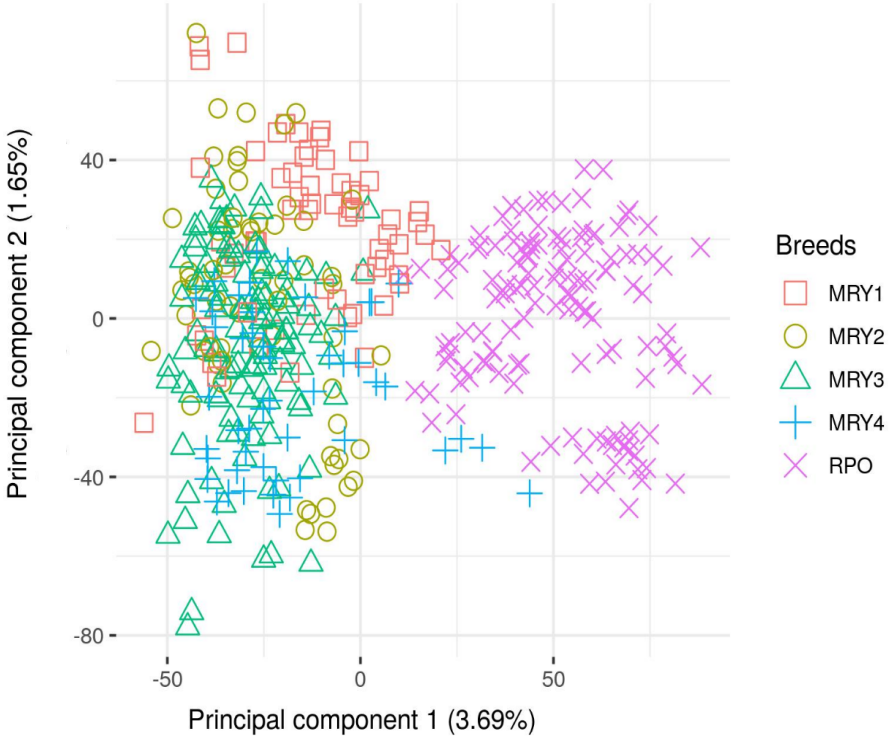
Distribution of MRY cohorts



Methodologies

- PCA
- Fixation index
- Genomic relationship matrix (GRM)

Principal component analysis



Fixation index

Cohort/breed	MRY1	MRY2	MRY3	MRY4
MRY1				
MRY2	0.010			
MRY3	0.015	0.009		
MRY4	0.019	0.013	0.006	
RPO	0.032	0.036	0.037	0.031

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Known history of RPO

- Important importation of MRY animals and semen before 1990 into Luxembourg
- After 1990, exchanges with Germany (Rotbunte DN)
- Last 20 years, more MRY importations in Germany
  - Direct and indirect relationships between MRY and RPO

Genomic relationship matrix

- 106 pairs of MRY and RPO with relationship > 0.10
- 26 MRY
- 47 RPO

Pedigree discovery

- 3 MRY-RPO pairs with a relationship ~0.47
  - Same MRY animal
  - RPO had relationships a bit lower than 0.25
    - ⇨ Sire and half-siblings
  - Confirmed by the pedigree for one pair of MRY-RPO

Implications

- Possibility to use the GRM to complete pedigree
- A better insight of the history between RPO and MRY with the PCA and fixation index
- Better collaboration between both breeds as we know how they relate to each other
- Further study about introgression

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Thank you for your attention!

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