Genetic analysis to support the re-establishment of the Kempen breed

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Kempen Breed (KRB)

Dual purpose cattle breed in the region “Kempen”

1972

All red-pied breeds merged into the herdbook of the Belgian red-pied
→ Crosses with Holstein

2012

Re-establishment
→ With farmers still maintaining the “old type”
Kempen Breed (KRB)

300 animals phenotypically registered (6 farms)
\[ \Rightarrow \text{using breeding standard from 1954} \]

BUT

No pedigree information
Many crosses
Many individuals still unregistered
Objective

Genetic diversity and population structure

Amount genetic information shared with related breeds
Within breed analysis

214 blood samples were genotyped on Illumina 54K

All breeding bulls
All cows > 7 years (<2007)

Quality Control

MAF: 1%
SNP call rate: 5%
Individual call rate: 5%

→ 207 individuals and 45 022 SNPs
Within breed: PCA
Within breed: diversity

Effective population size = 55
(Weir & Hill 1980 adapted by Waples 2006)

Average inbreeding = 2.7%
(Yang et al. 2010)
Between breeds analysis

Relation between KRB and 9 related breeds
→ 654 individuals on Illumina 54K or 770K
  Belgian Blue, Deep Red Cattle, MRY, Maine Anjou, Eastern Belgium Red and White, Red Holstein, Black Holstein, Flemish Red, Improved Red

Quality Control
  MAF  1%
  SNP call rate  5%
  Individual call rate  5%

→ 616 individuals with 32 943 SNPs
Between breeds: PCA

![PCA Plot]

**Breeds**
- Belgian Blue
- Black Holstein
- Deep Red
- Eastern Belgium Red Pied
- Flemish Red
- Improved Red
- KRB
- MRY
- Maine Anjou
- Red Holstein
Between breeds: STRUCTURE

Burn in: 10 000
MCMC rep: 30 000

KRB: Kempen Breed
BBB: Belgian Blue
DR: Deep Red (Brandrood)
MRY: Meuse-Rhin-Yssel
MA: Maine-Anjou

EBRW: Eastern Belgium Red and White
RH: Red Holstein
IR: Improved Red
FR: Flemish Red
BH: Black Holstein

KU LEUVEN
Between breeds: STRUCTURE

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Between populations: Clustering

Clustering of these 3 populations using DAPC (R)

<table>
<thead>
<tr>
<th>Breed</th>
<th>Cluster</th>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Red Cattle Breed</td>
<td></td>
<td>40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Kempen Breed</td>
<td></td>
<td>84</td>
<td>77</td>
<td>46</td>
</tr>
<tr>
<td>Eastern Belgian Red Pied</td>
<td></td>
<td>50</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Conclusion

Variable breed, low average inbreeding

However

- Low effective population size
- Limited amount of unrelated breeding bulls

The Kempen breed is similar to Eastern Belgium Red Pied, Deep Red and Improved Red

- Possible to exchange genetic material without losing its characteristics and maintain the breed in the future
We would like to thank

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Gautier et al. (2009)

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