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If one is not enough - Using whole-genome sequencing data from pooled workers to explore the admixture pattern of honey bee populations

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Overview

- Introduction
  - Importance of *Apis Mellifera*
  - Biology of *Apis Mellifera*
  - Breed?
  - Honey bee breeds in Europe

- Material and Methods
  - Pool-sequencing of honey bee workers
  - Methods to determine admixture levels of Irish dark honey bees
  - NetView to explore high-resolution population structures

- Results
  - Admixture results of Irish dark honey bees
  - Global diversity of *Apis Mellifera Mellifera* in a pan-European dataset

- Conclusion and take home message

Introduction – Importance of *Apis Mellifera*

Current threats

Climate Change

Varroa mite

Bee keeping

Colony survival

Honey

Pollination

Biodiversity

Services

Introduction – Biology of *Apis Mellifera*

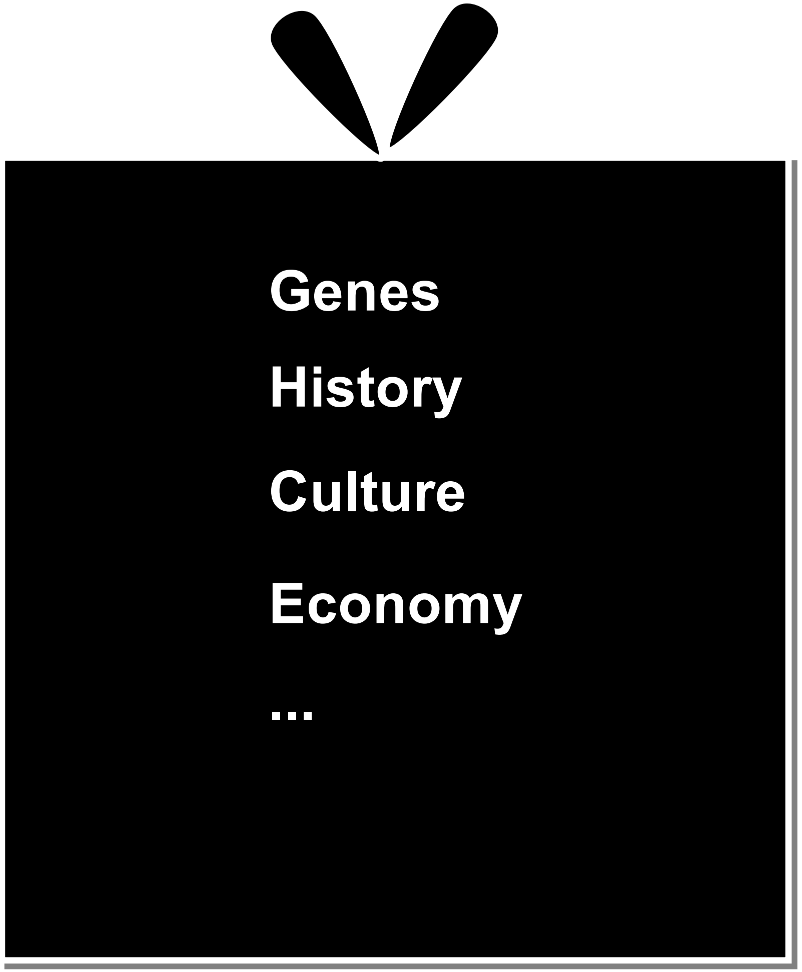
Queen mating occurs in flight with up to 20 drones over a distance of 15 km

Introduction - Breed?

- **„A breed is a breed, if enough people say it is“ (K. Hammond)**
- **There is no common definition for the term breed!**
- In Europe breed-specific characteristics are determined by the respective associations, which are responsible for the breeding programme.

yellow bee vs. dark bee

Introduction - Breed?



Genes

History

Culture

Economy

...

Introduction – European honey bee brees

M-Line

A. m. mellifera


Bibba.com

A. m. ligustica

C-Line

C-Line

A. m. carnica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Buckfast


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C-Line
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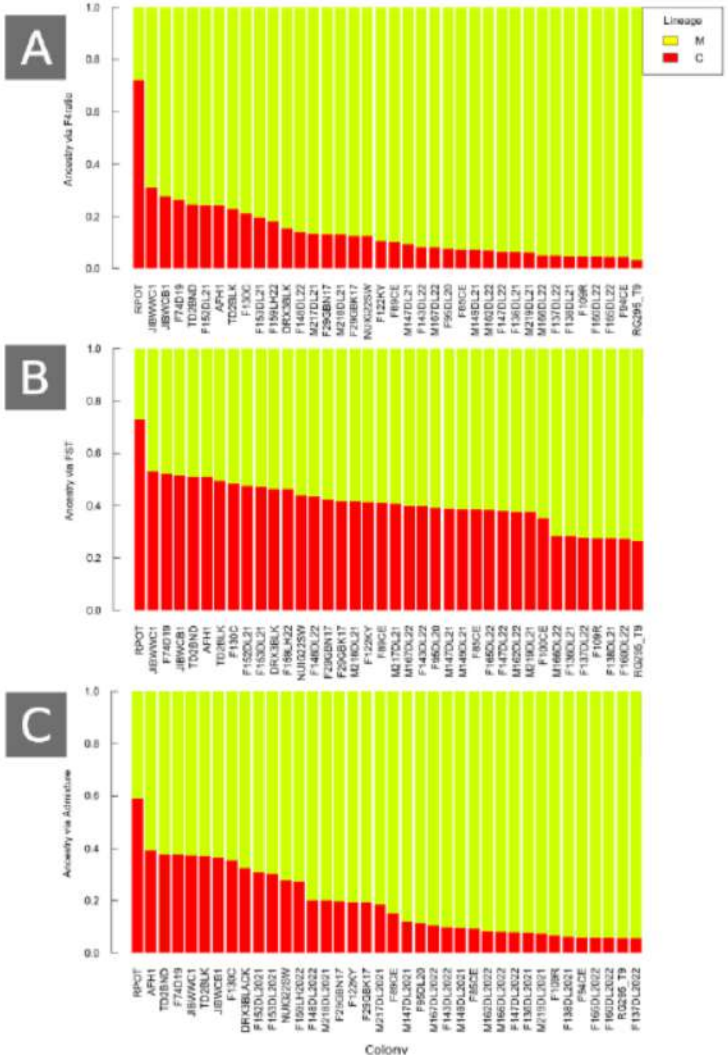
Material and Methods

- **Data collection:** 30 pooled workers of including 38 Irish *Apis mellifera mellifera* and 10 *Apis mellifera carnica* colonies
- **Pool sequencing:** Novoseq 6000^{TM} platform (50x coverage)
- **Alignment:** Reads were aligned to Amel_HAV3.1 reference
- **Calculations of admixture levles:** Using a total of 773,705 genome-wide SNPs and three different methods (F4-Ratio, FST and Admixture)
- **Population structure analysis:** We performed a fine-scale population structure analysis (NetView) of European honey bees (including a total of 442 colonies)

Results – Admixture patterns

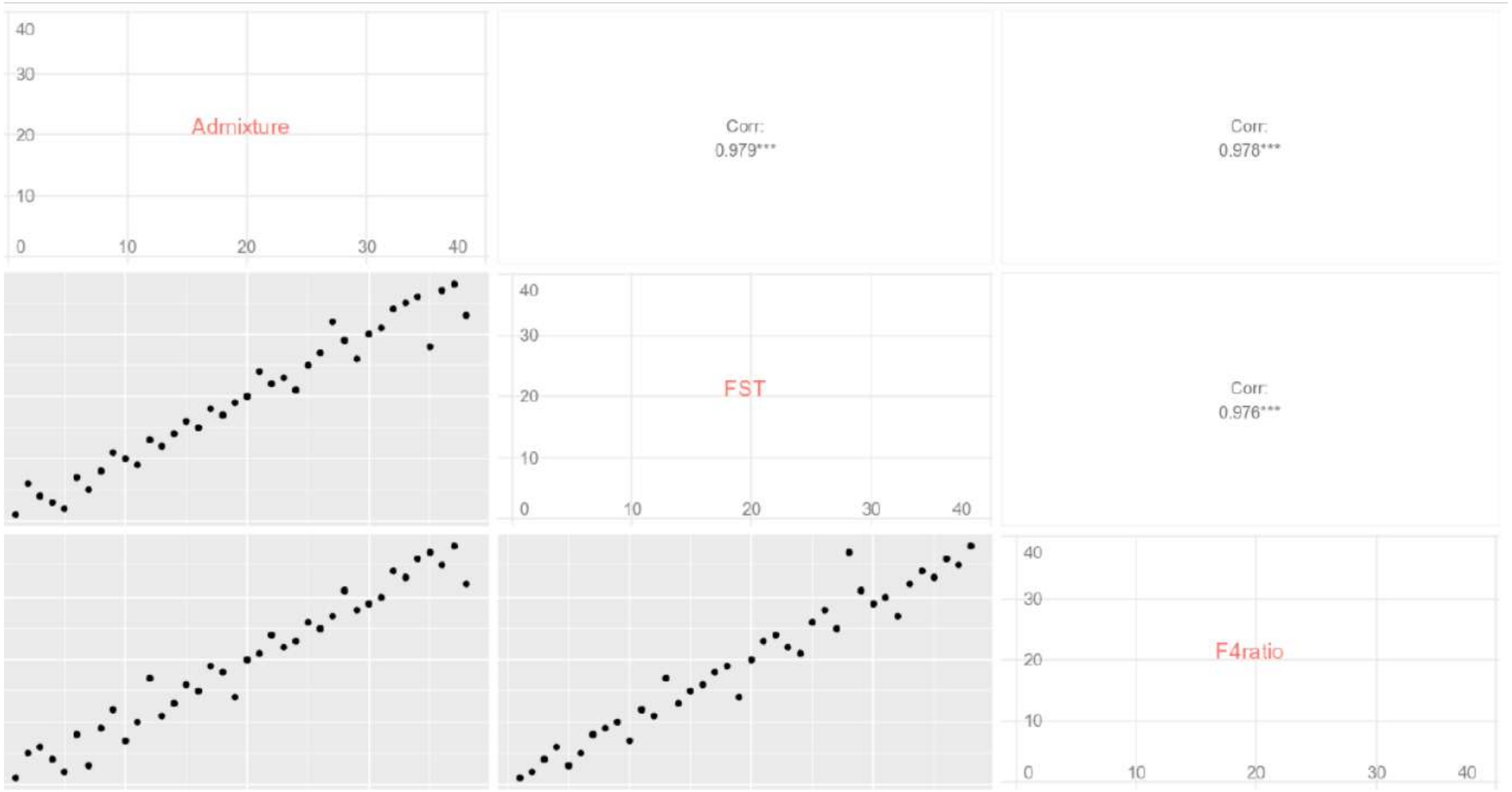


F4-Ratio

FST

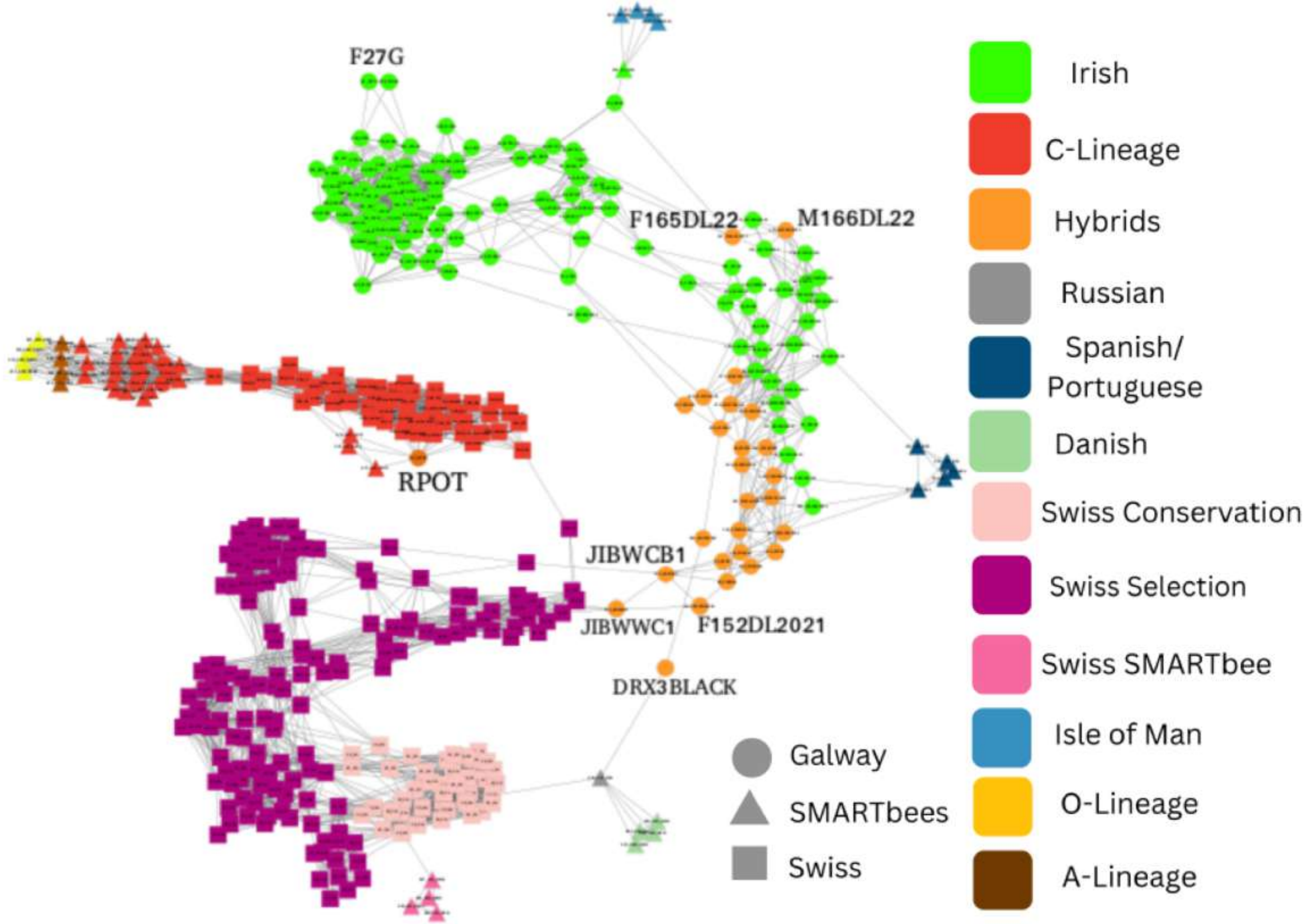
Admixture

Results – Admixture comparison



Results – European honey bee dataset

NetView of 442 honey bee colonies



Conclusion and take home message

- The high concordance between the three applied methods indicates they perform equally well detecting most hybridized colonies
- It is essential to define appropriate reference populations prior to admixture computations and to apply adequate thresholds to enhance the conservation native honey bees
- To merge different pooled workers (10,30 and 500) into a pan-European dataset
- NetView allows to explore fine-scale population structures within and between honey bee colonies

Thank you for your attention

Markus Neuditschko,
Stephen Smith &
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