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Secondary contact of hedgehogs in central Europe

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**** e3 (Population genomics)***

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5.8 Ma.

3.0 Ma.

Erinaceus europaeus
European hedgehog

Erinaceus roumanicus
Northern white-breasted hedgehog

Erinaceus concolor
Southern white-breasted hedgehog

- *E. europaeus*
- *E. roumanicus*
- hybrid
- *E.concolor*
- *Hemiechinus*

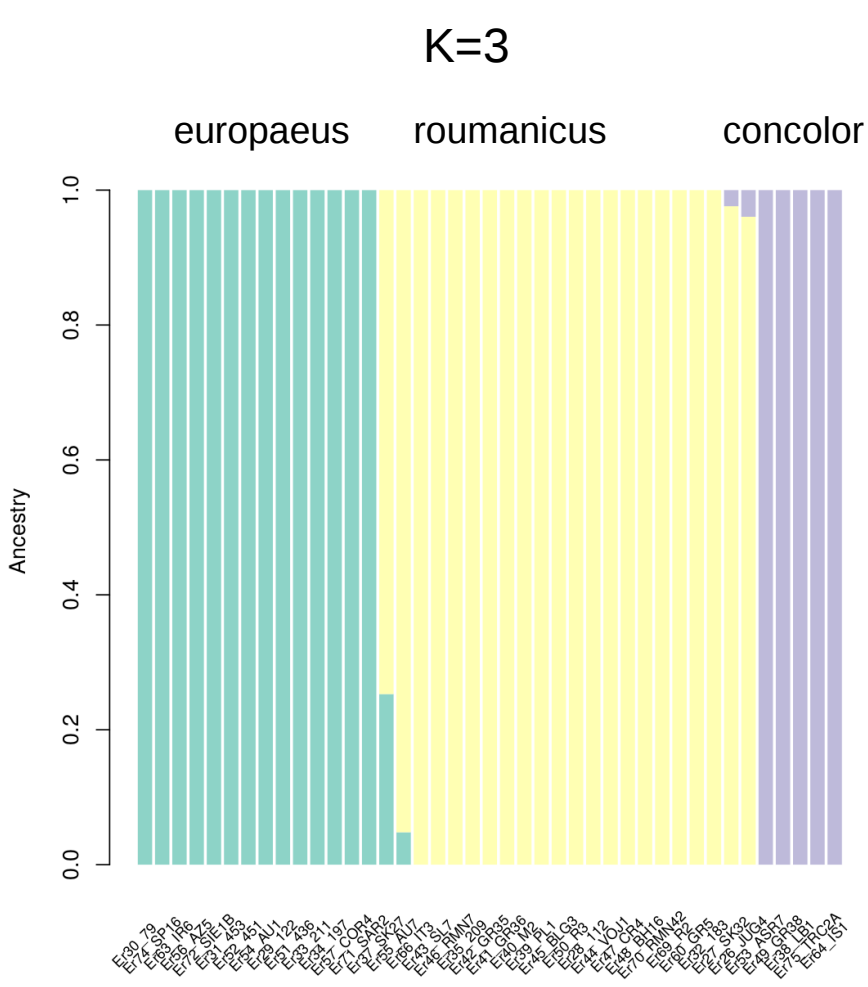
Goals

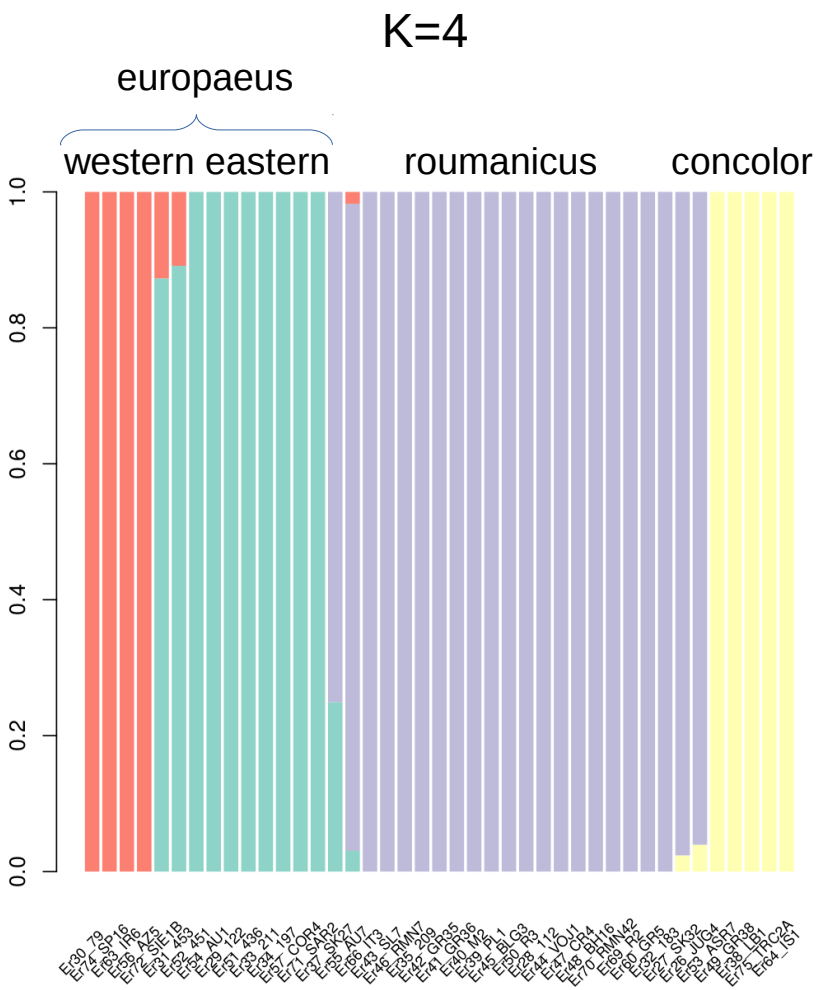
- Check classic model of post-glacial colonization.
- Quantify hybridization.
- Does natural selection determine the fate of introgressed variation?

Methods

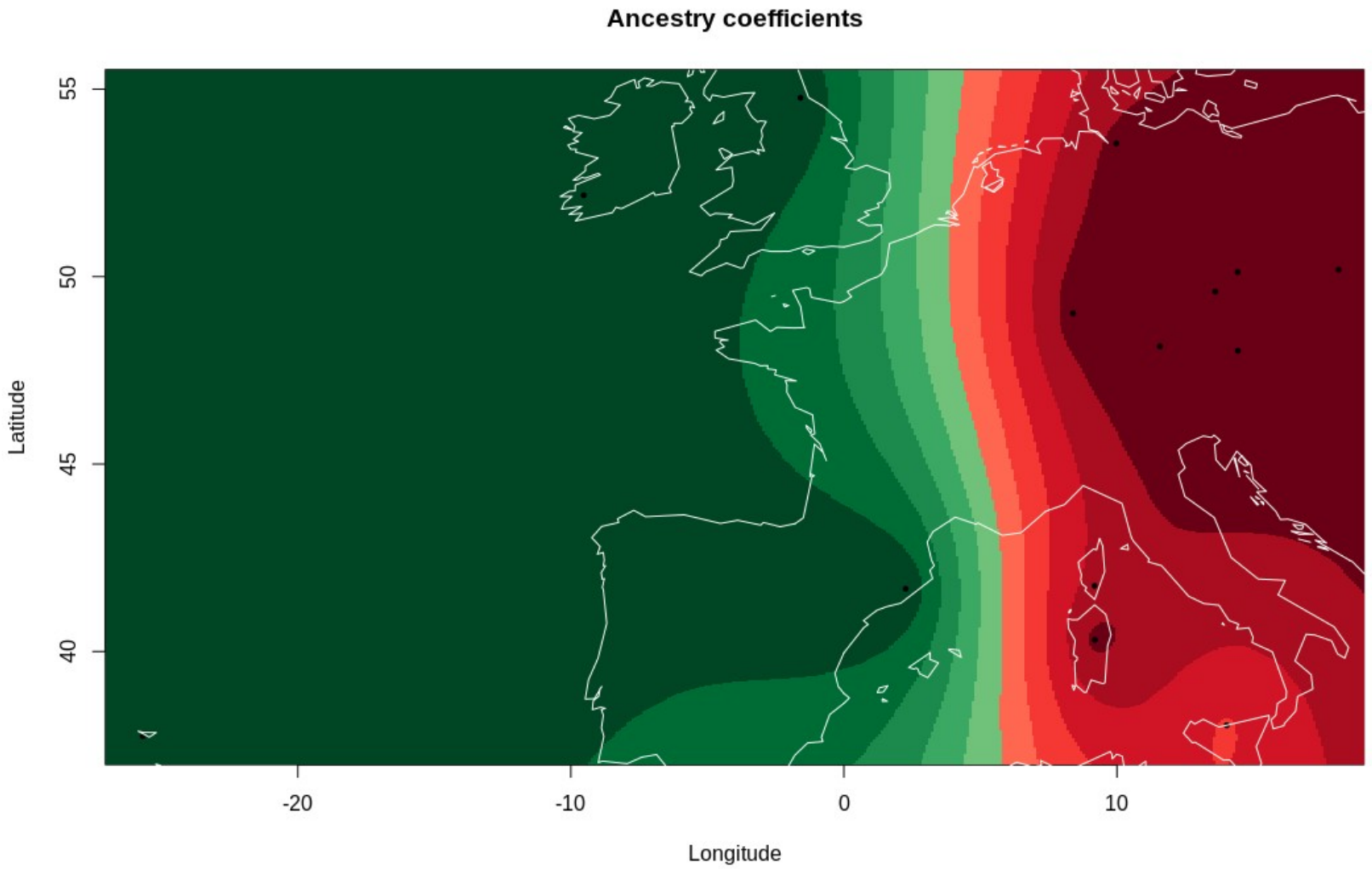
- Restriction-Associated DNA (RAD) sequencing
  - ~100,000 SNPs in 16 eur., 25 rou., 5 con., 1 Hem.
- Model-based ancestry estimation (Admixture).
- Geographically informed ancestry estimation (TESS3).
- Inference of local blocks of admixture (LAMP).
- Test of historical introgression (ABBA/BABA test).

Results. Admixture.

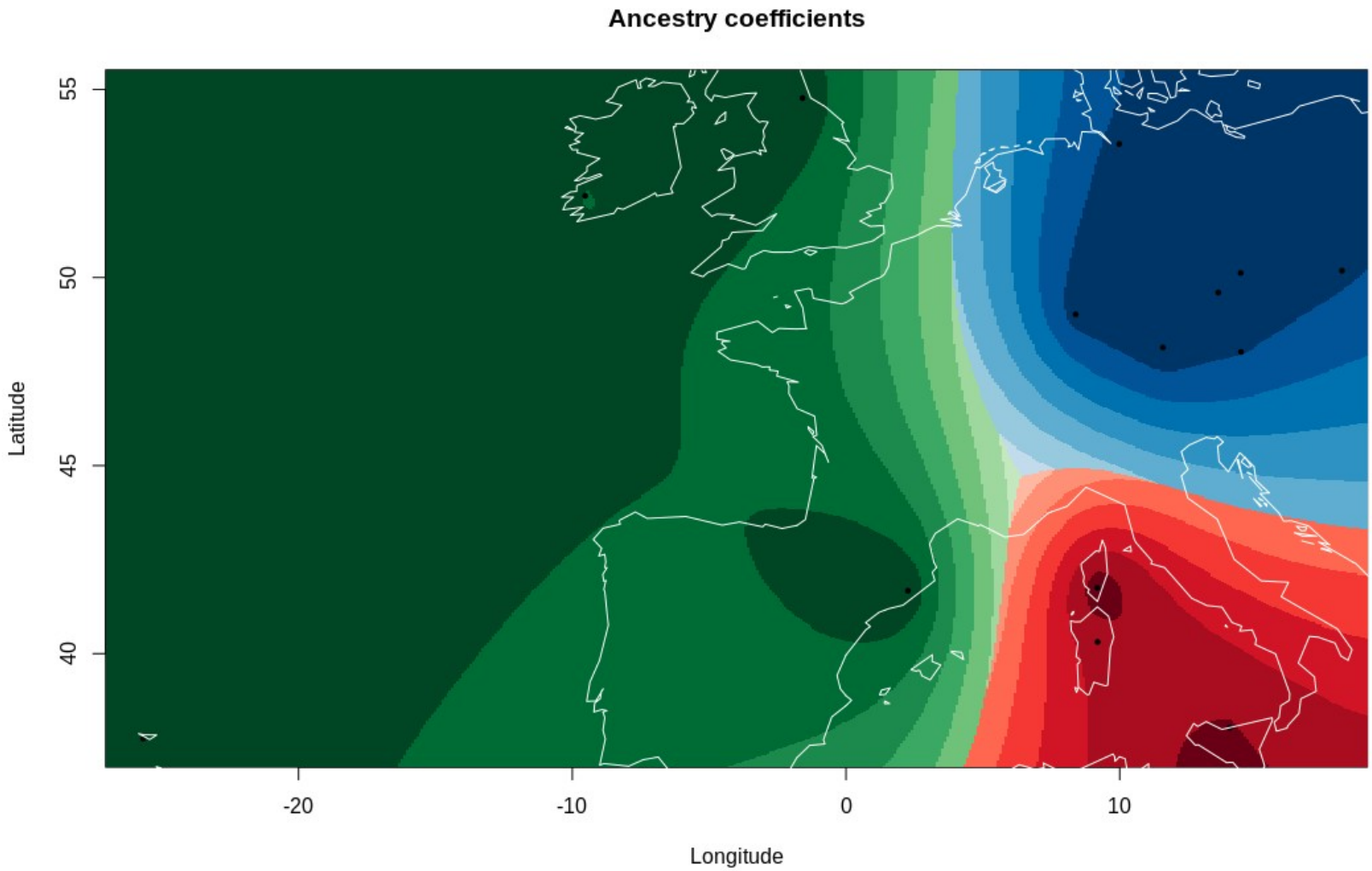




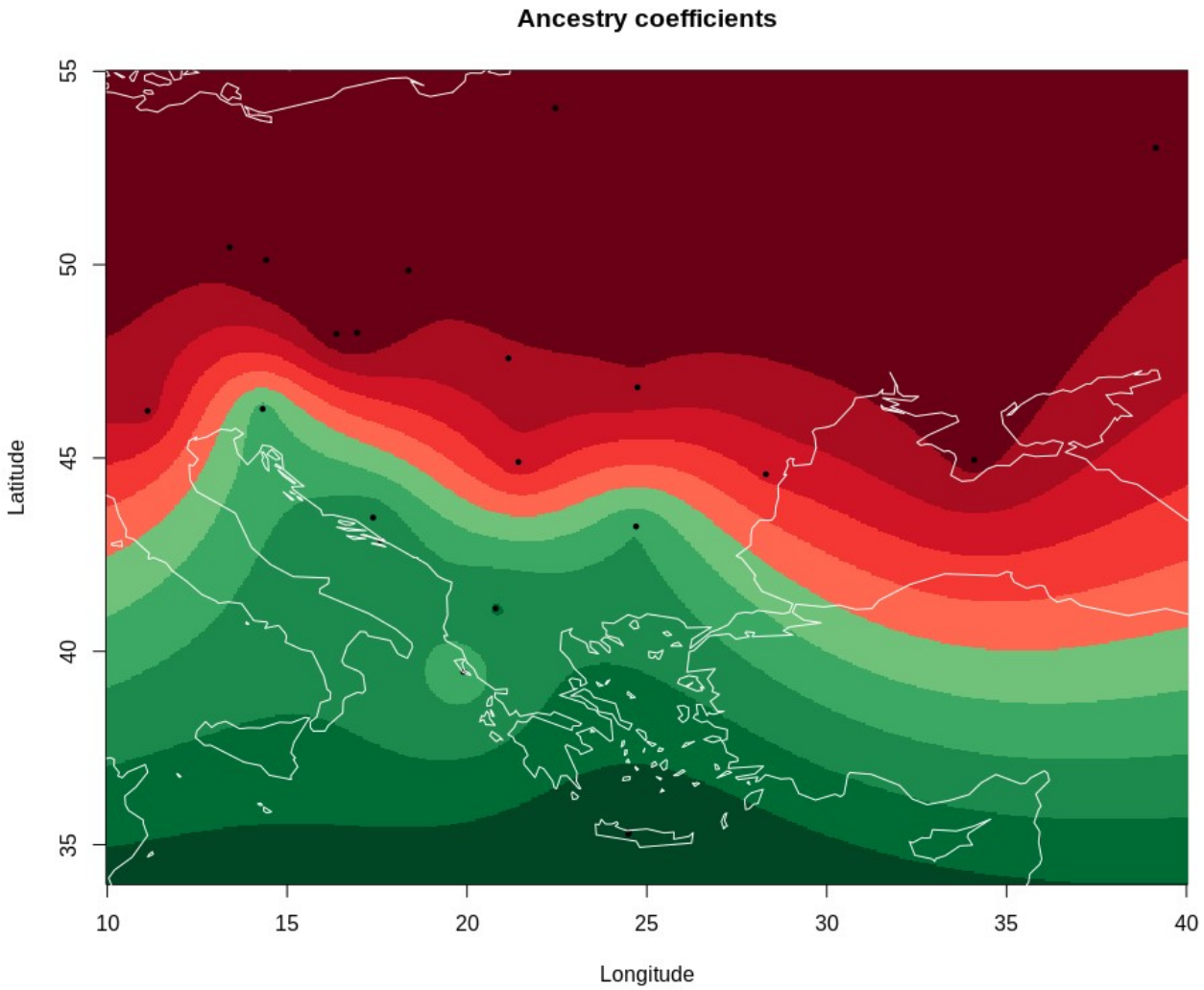
Results. TESS3. *E. europaeus*, K=2.



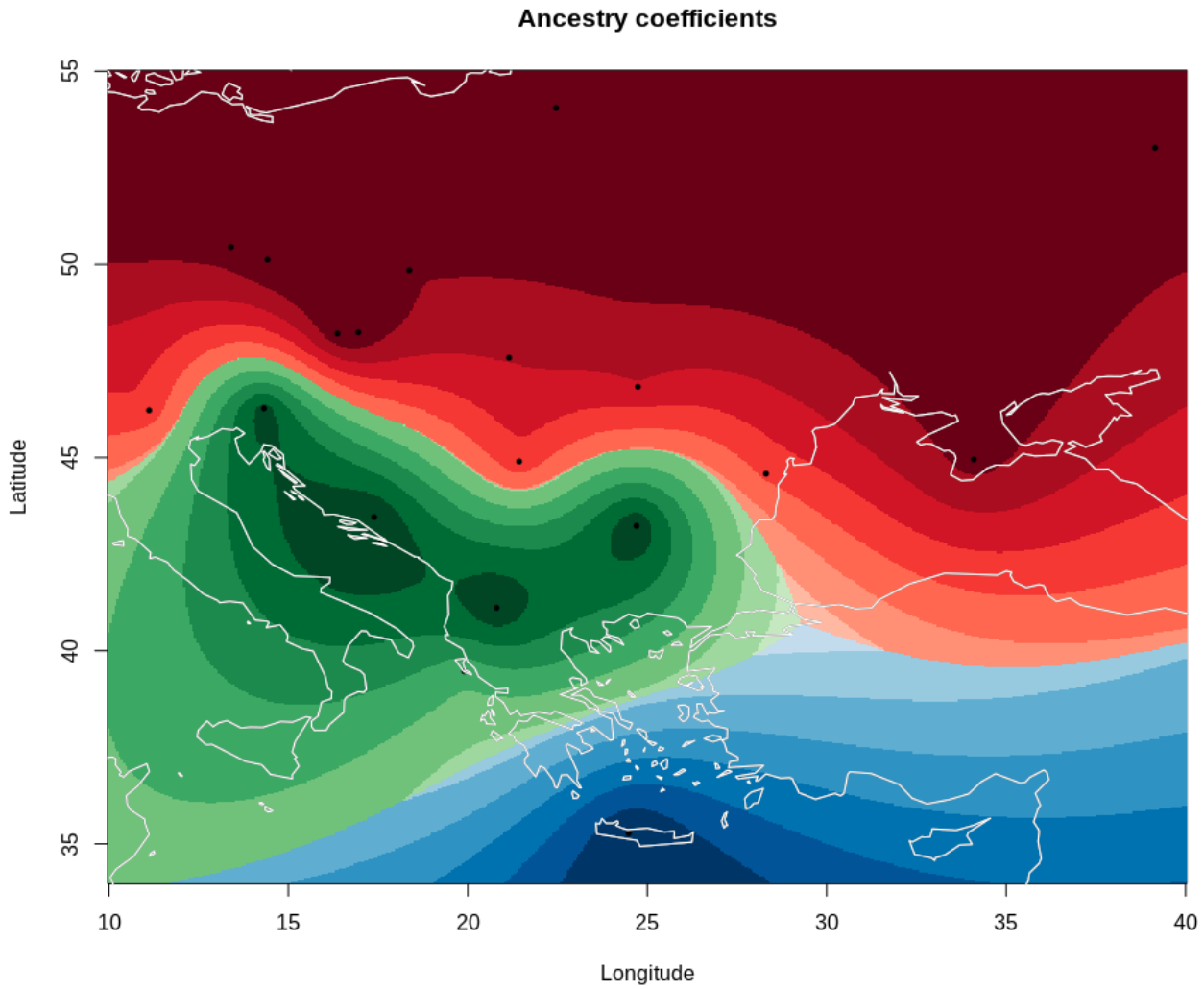
Results. TESS3. *E. europaeus*, K=3.



Results. TESS3. *E. roumanicus*, K=2.

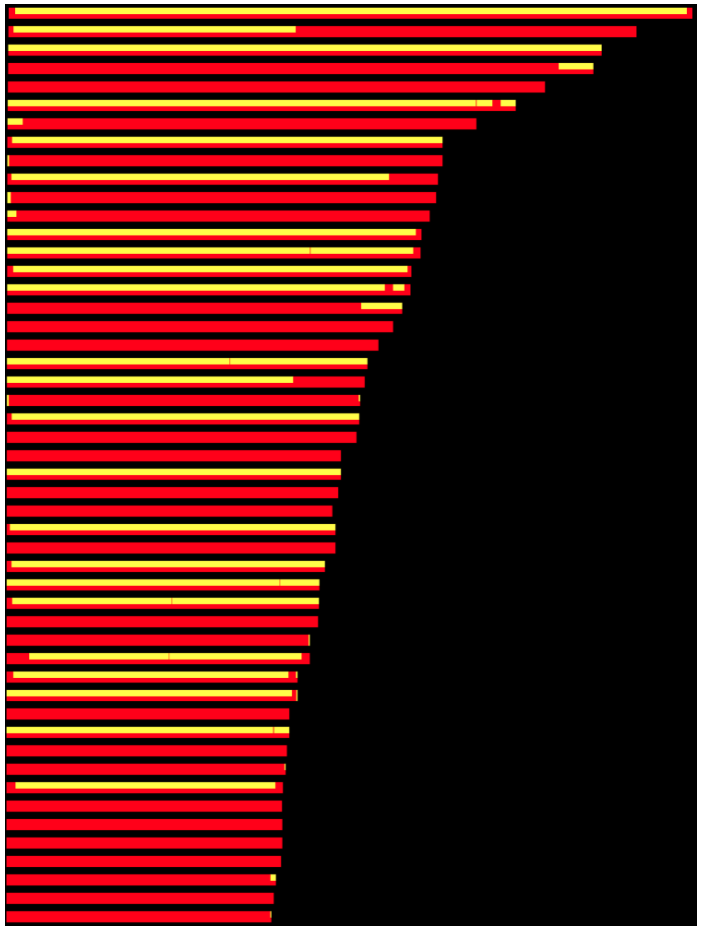


Results. TESS3. *E. roumanicus*, K=3.

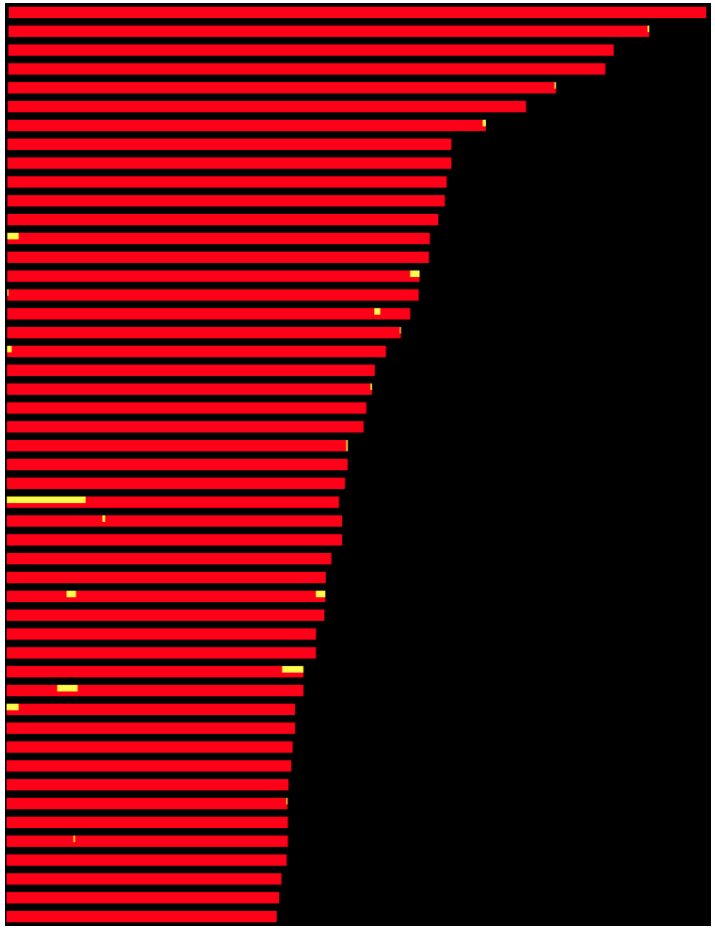


Results. Genomic blocks of ancestry (LAMP).

The «hybrid» individual



Unexpected admixed individual

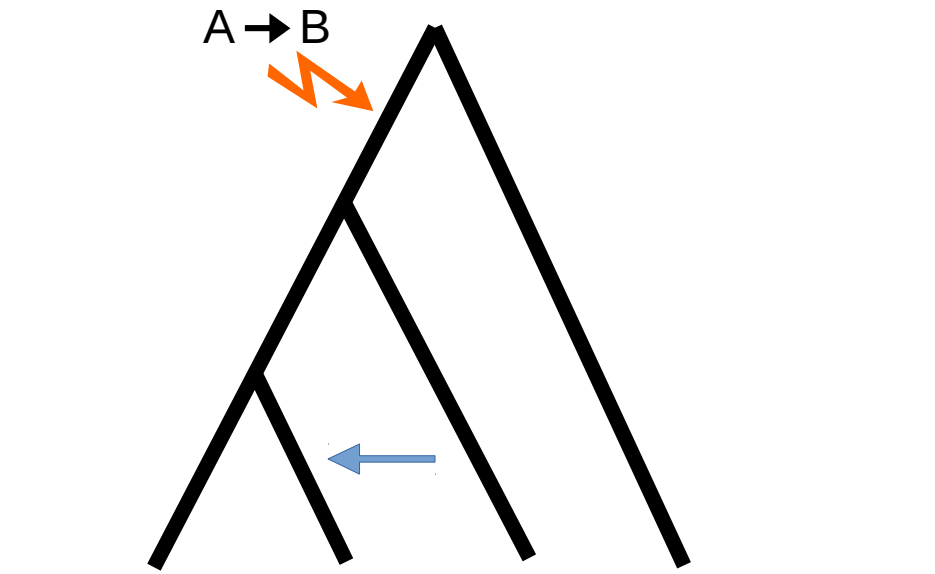


roumanicus

europaeus

50 largest contigs
(6.7 – 17.4 Mb)

Results. ABBA/BABA or D-test of introgression.

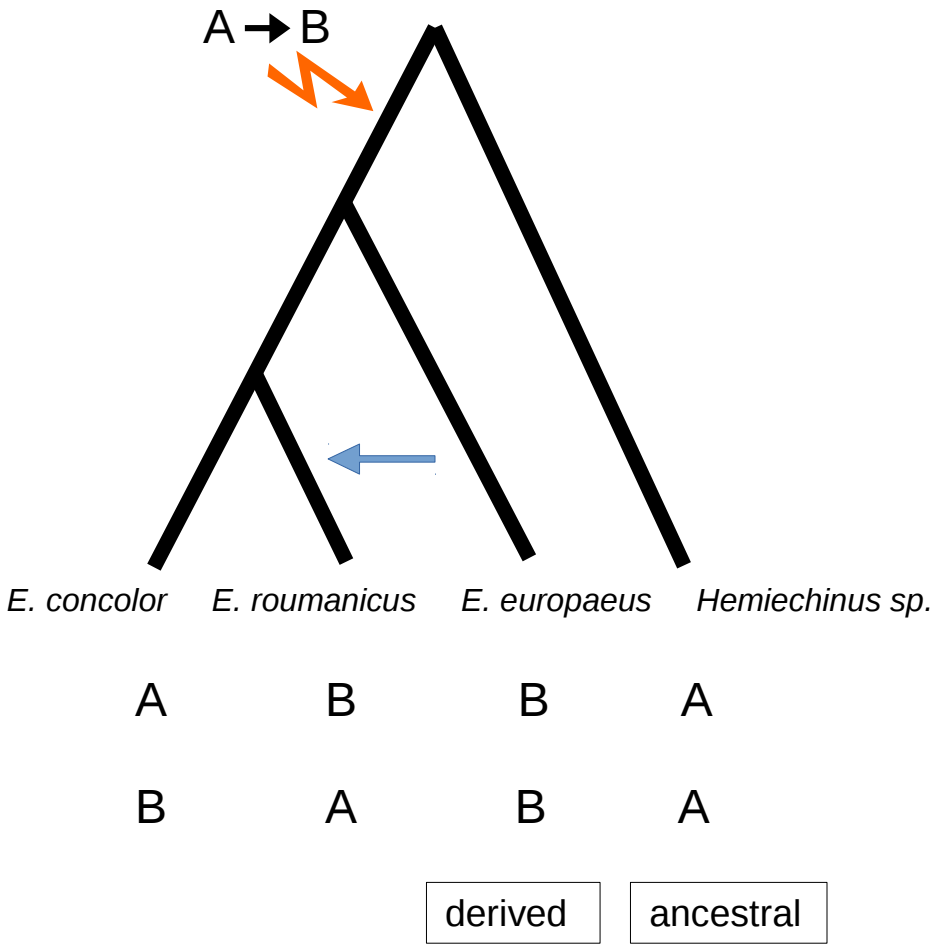


In the absence of introgression between *E. europaeus* and *E. roumanicus*, incomplete lineage sorting would produce a similar number of sites with the ABBA and the BABA patterns.

D-test compares the frequency of both patterns.

f statistics quantify the portion of the genome affected by introgression.

Results. ABBA/BABA or D-test of introgression.



D (±S.E.)	0.154 (±0.018)
p-value	3.1E-18
Num. sites	99365
f	0.0432
f_{HOM}	0.0395
f_d	0.0234

D > 0

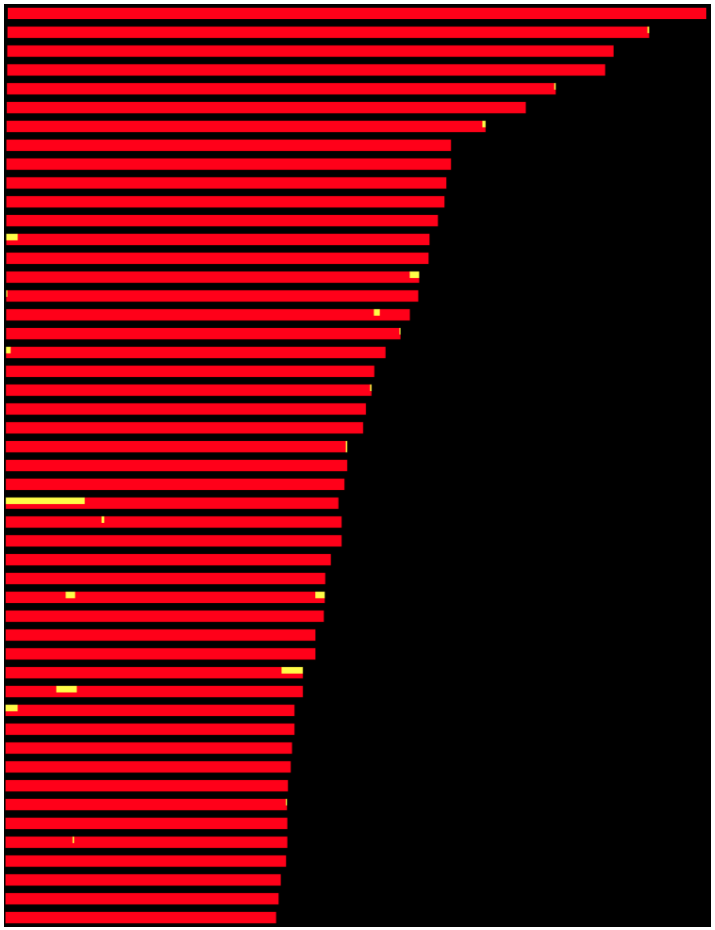
↓

ABBA > BABA

↓

Gene flow from *E. europaeus* to *E. roumanicus*

Results. Association bw. D-test and blocks of admixture



Introgressed variants may be neutral, deleterious or beneficial.

If they are neutral, they must be lost randomly.

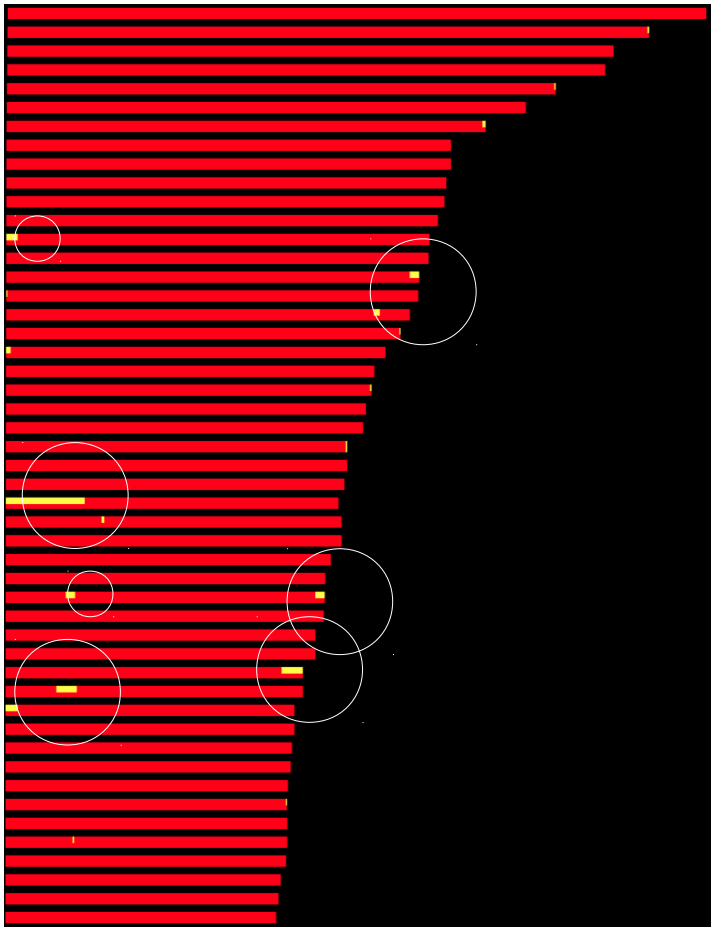
If natural selection governs the fate of introgressed variation, independent signals of introgression should be associated in the genome.

Results. Association bw. D-test and blocks of admixture

admixed blocks

D = 0.372 (±0.138)
p-value = 0.0072

f = 0.104
f_{HOM} = 0.106
f_d = 0.059



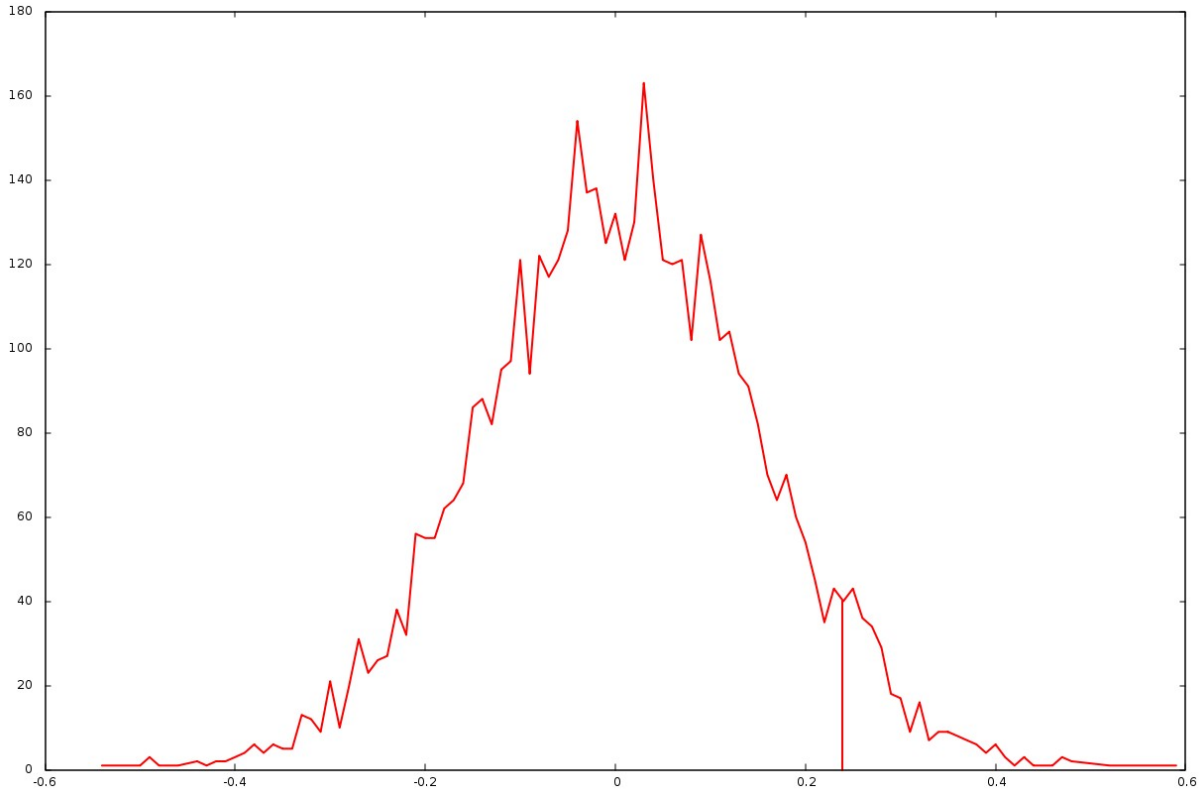
E. roumanicus background

D = 0.133 (±0.020)
p-value = 1.25E-11

f = 0.037
f_{HOM} = 0.034
f_d = 0.020

Are differences significant?

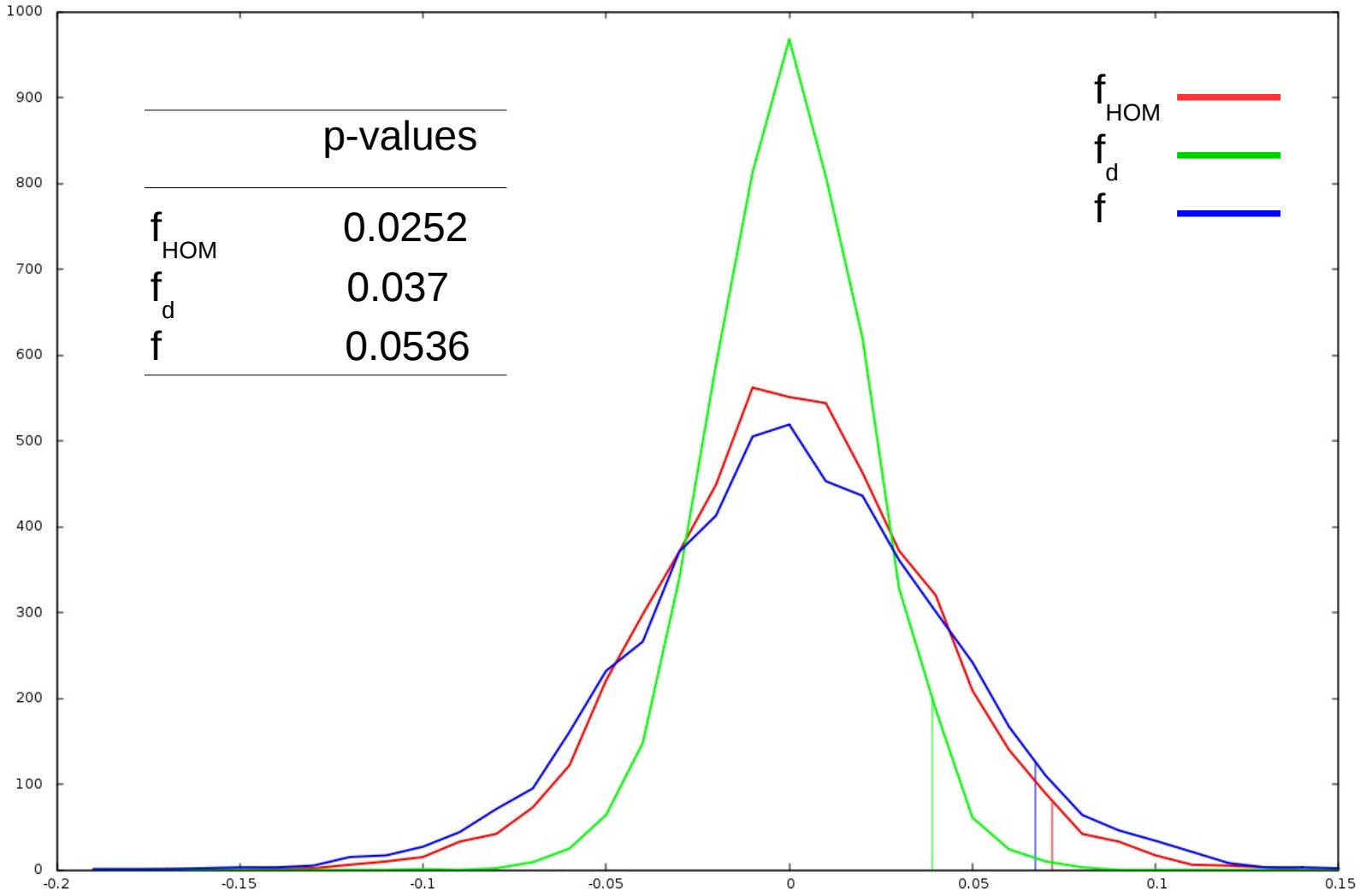
Results. Association bw. D-test and blocks of admixture



Null distribution of the difference in *D* statistic between admixed genomic blocks and rest of the genome, obtained by shuffling the admixed regions of individual Er55.

p-value: 0.0608

Results. Association bw. D-test and blocks of admixture



	p-values
f_{HOM}	0.0252
f_d	0.037
f	0.0536

Conclusions

- Support for the classic model of post-glacial colonization.
- Detection of low levels of hybridizacion, both historical and recent, in the central European contact zone.
- Evidence that natural selection determines the fate of the introgressed variation.

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