Emergence and diversification of a highly invasive tree pathogen lineage

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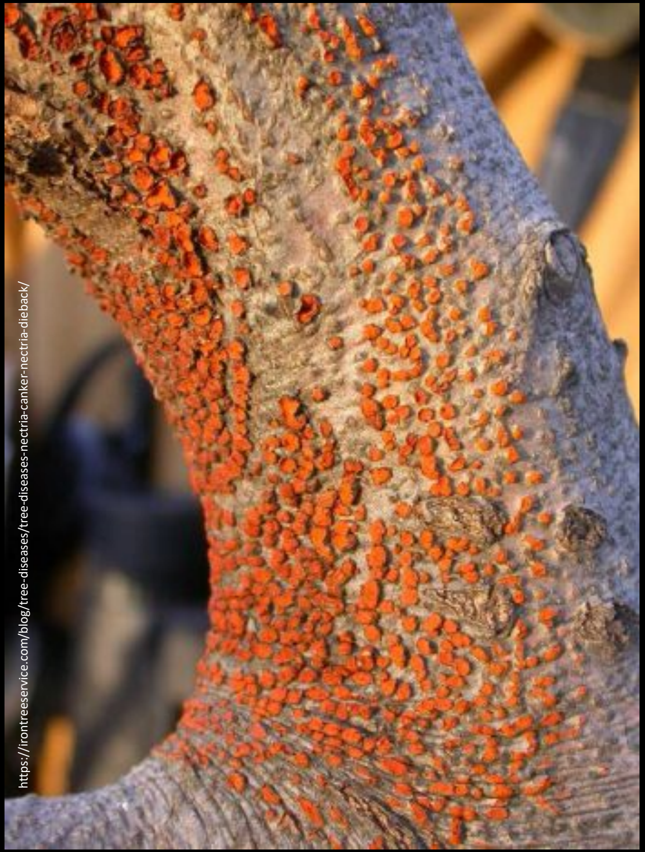
Nick Talbot, University of Exeter


https://daily.jstor.org/bats-with-white-nose-syndrome/


https://agrinfobank.com.pk/


https://irontreeservice.com/blog/tree-diseases/tree-diseases-nectria-canker-nectria-dieback/

Chestnut blight – *Cryphonectria parasitica*

Pathogen vs saprophyte

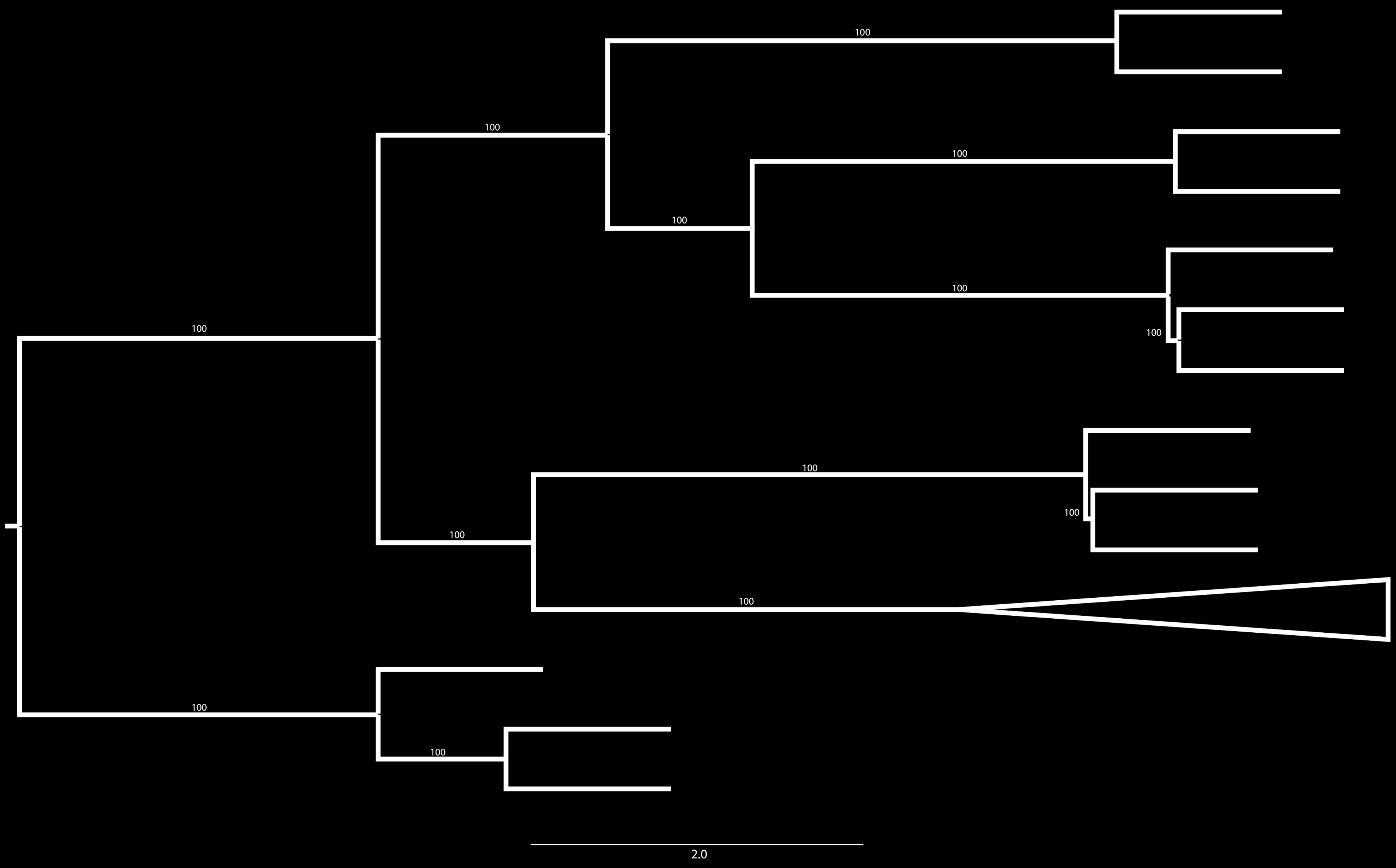
Pathogen vs saprophyte

Emergence & diversification of a highly invasive pathogen lineage

Pathogen vs saprophyte

Emergence & diversification of a highly invasive pathogen lineage

Illumina WGS data (~300 isolates)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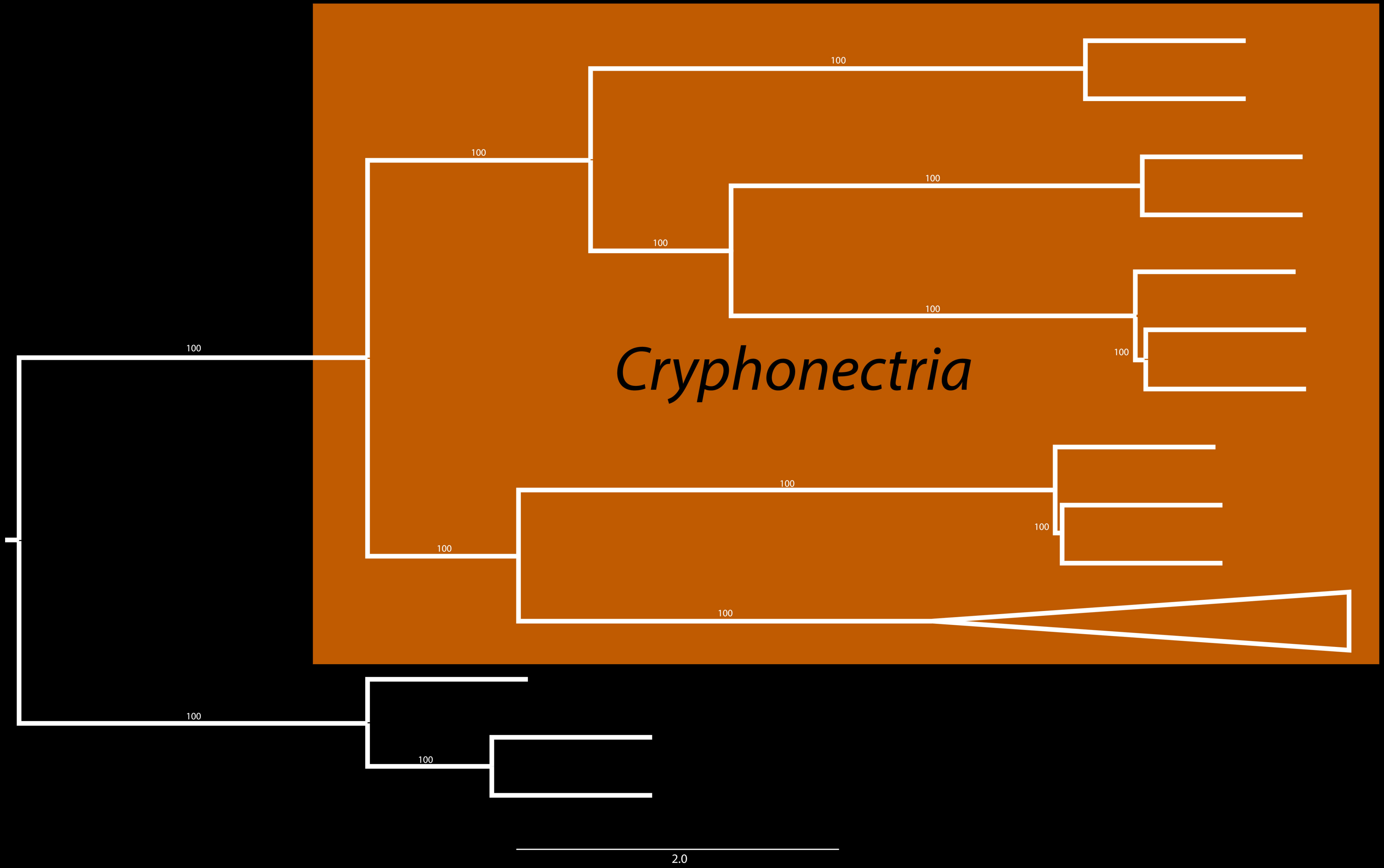
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Cryphonectria
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100
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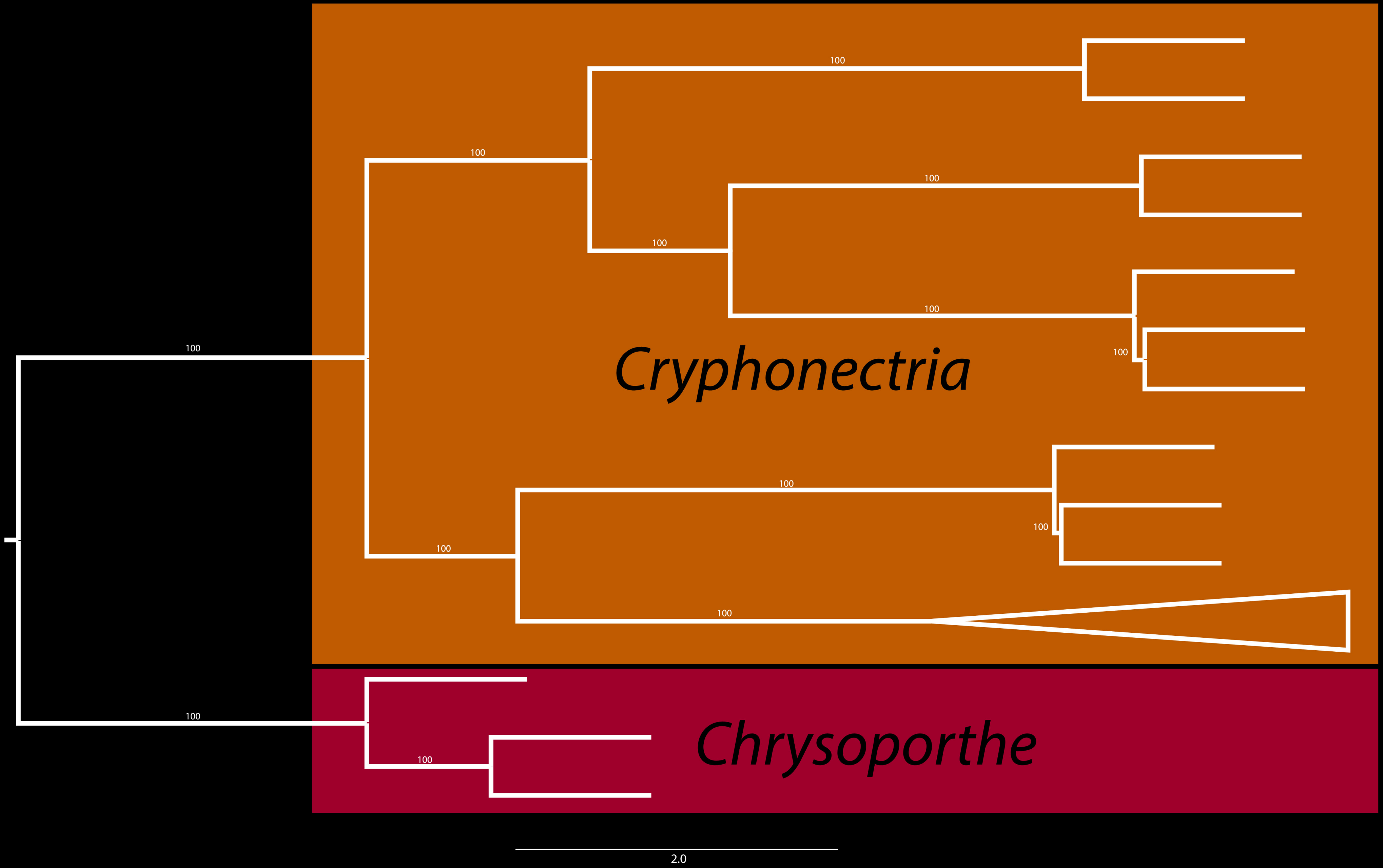
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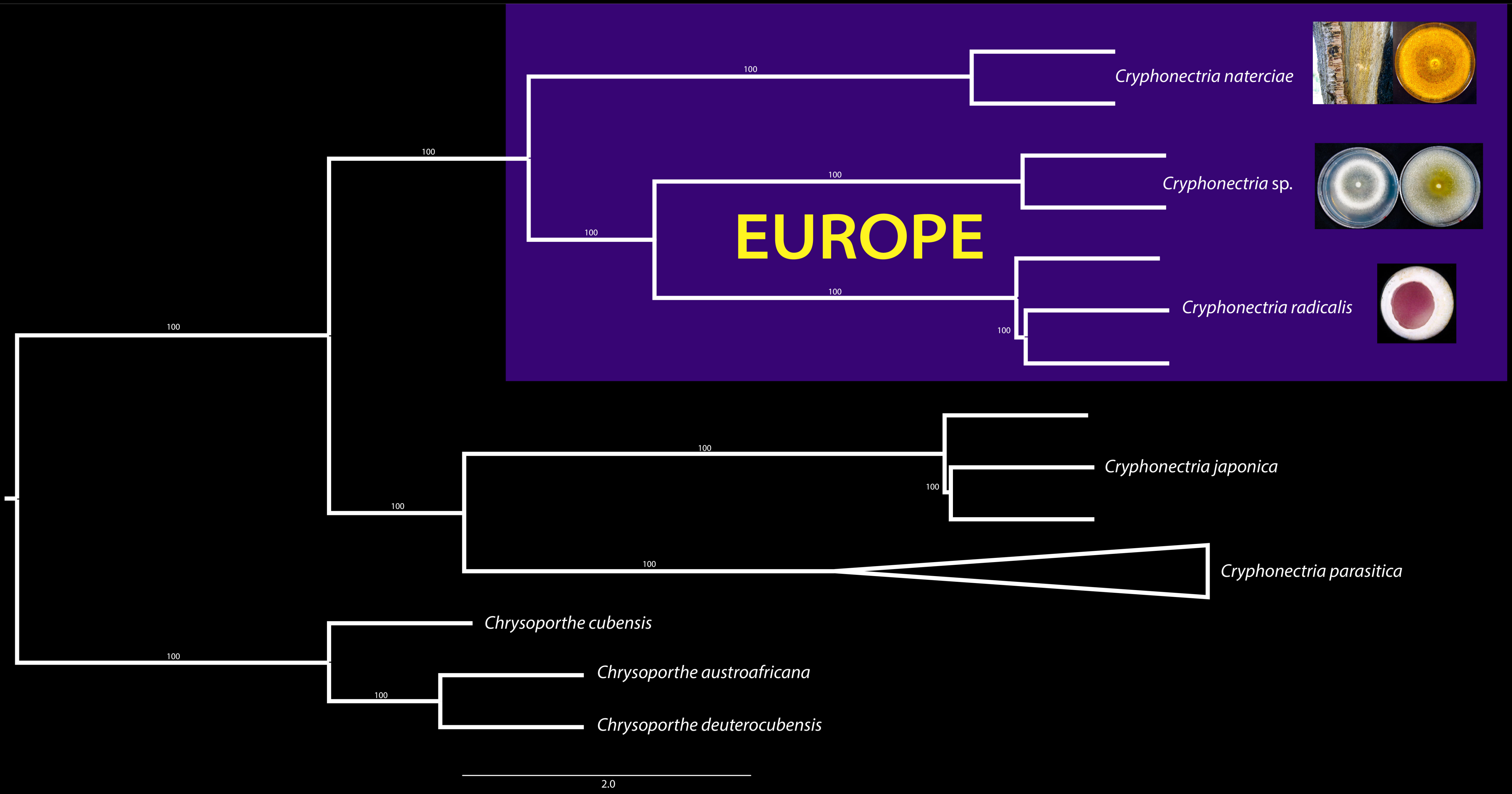
100
100
100
100
Chrysoporthe
100
2.0


EUROPE
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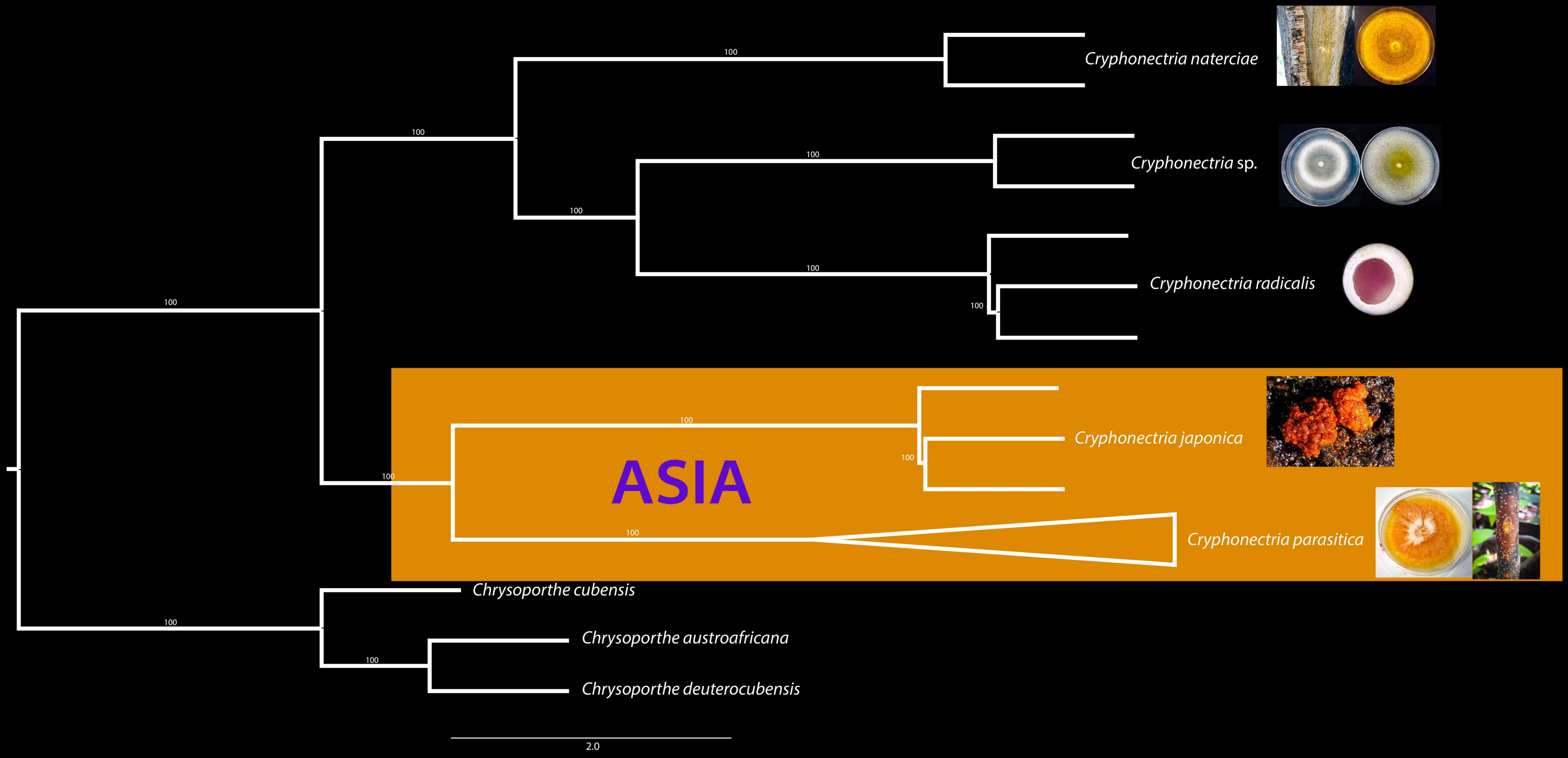
100
100
Cryphonectria sp.
100
100
100
Cryphonectria radicalis
100
100
Cryphonectria japonica
100
100
Cryphonectria parasitica
100
Chrysoporthe cubensis
100
Chrysoporthe austroafricana
Chrysoporthe deuterocubensis
2.0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Cryphonectria naterciae
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Cryphonectria radicalis
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Cryphonectria japonica
100
ASIA
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Chrysoporthe cubensis
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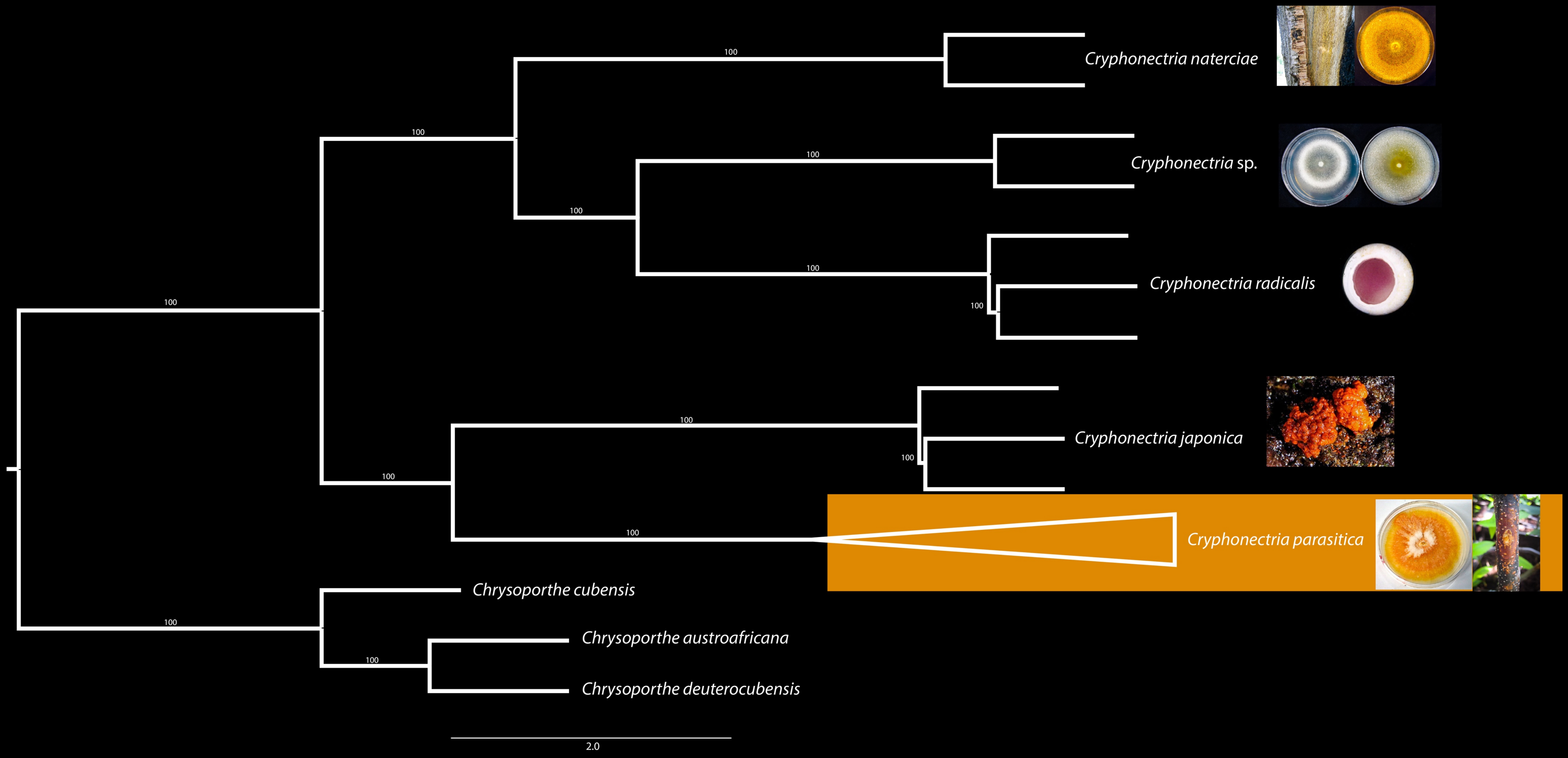
100
Chrysoporthe deuterocubensis
2.0



100
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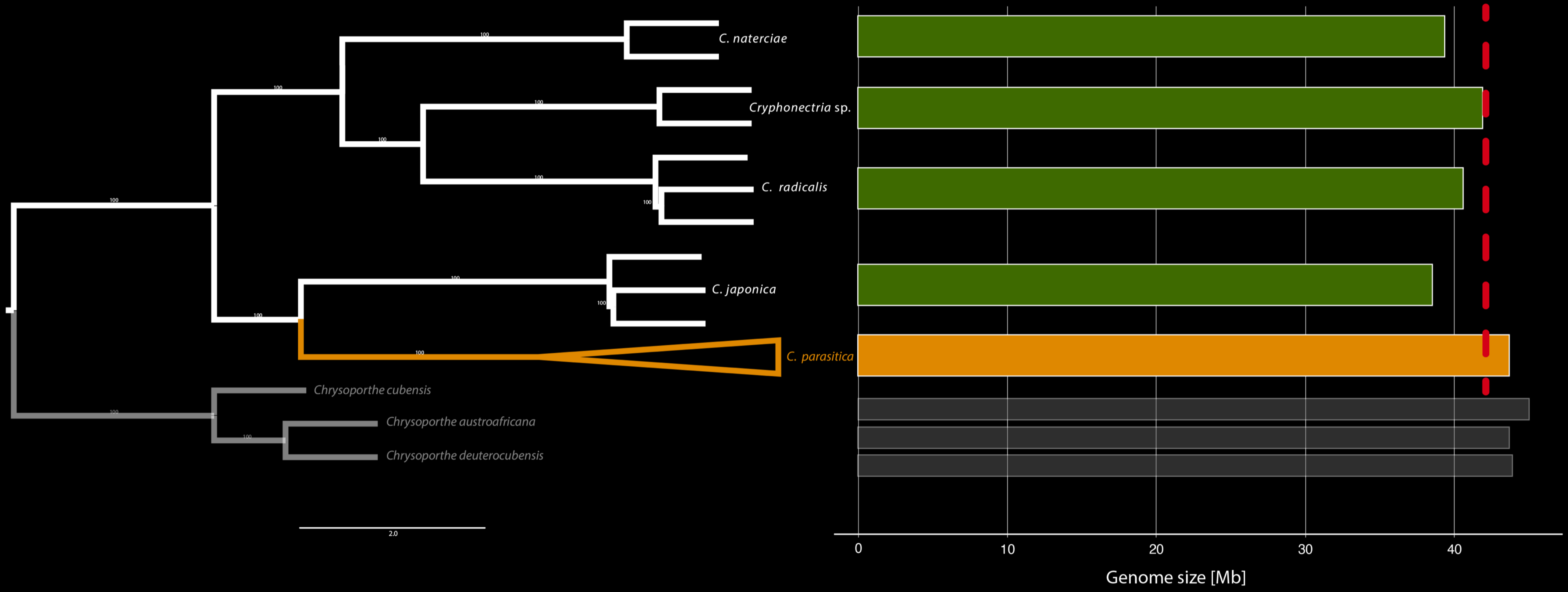
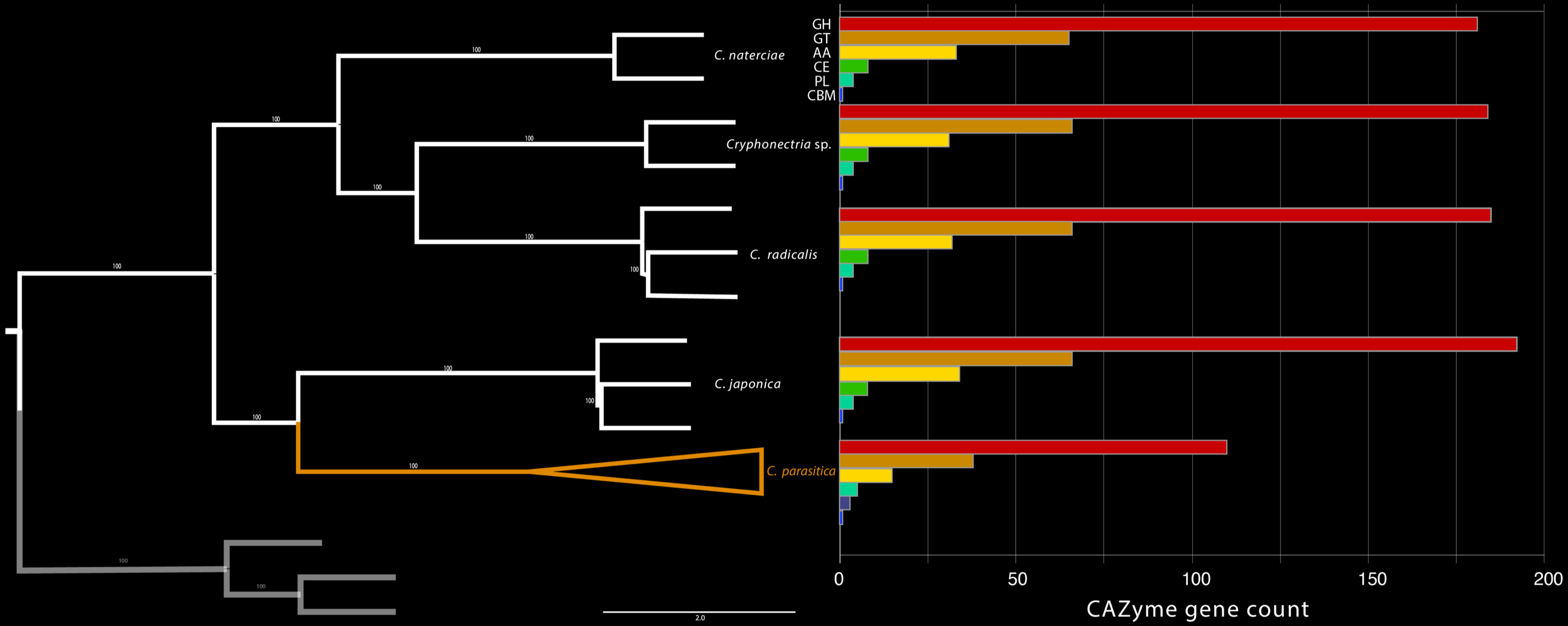
100
Cryphonectria naterciae
Cryphonectria sp.
Cryphonectria radicalis
Cryphonectria japonica
Cryphonectria parasitica
Chrysoporthe cubensis
Chrysoporthe austroafricana
Chrysoporthe deuterocubensis
2.0

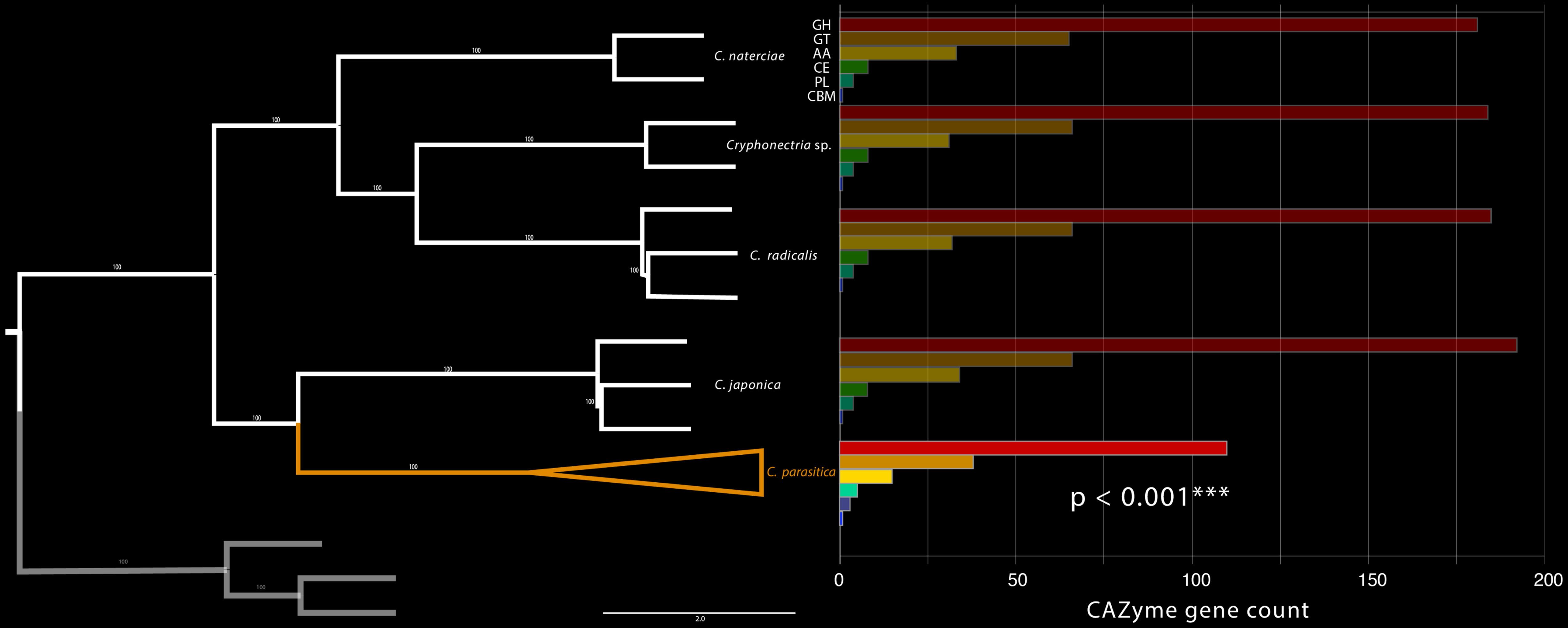
Genome size


C. naterciae
Cryphonectria sp.
C. radicalis
C. japonica
C. parasitica
Chrysoporthe cubensis
Chrysoporthe austroafricana
Chrysoporthe deuterocubensis
100
2.0
0
10
20
30
40
Genome size [Mb]

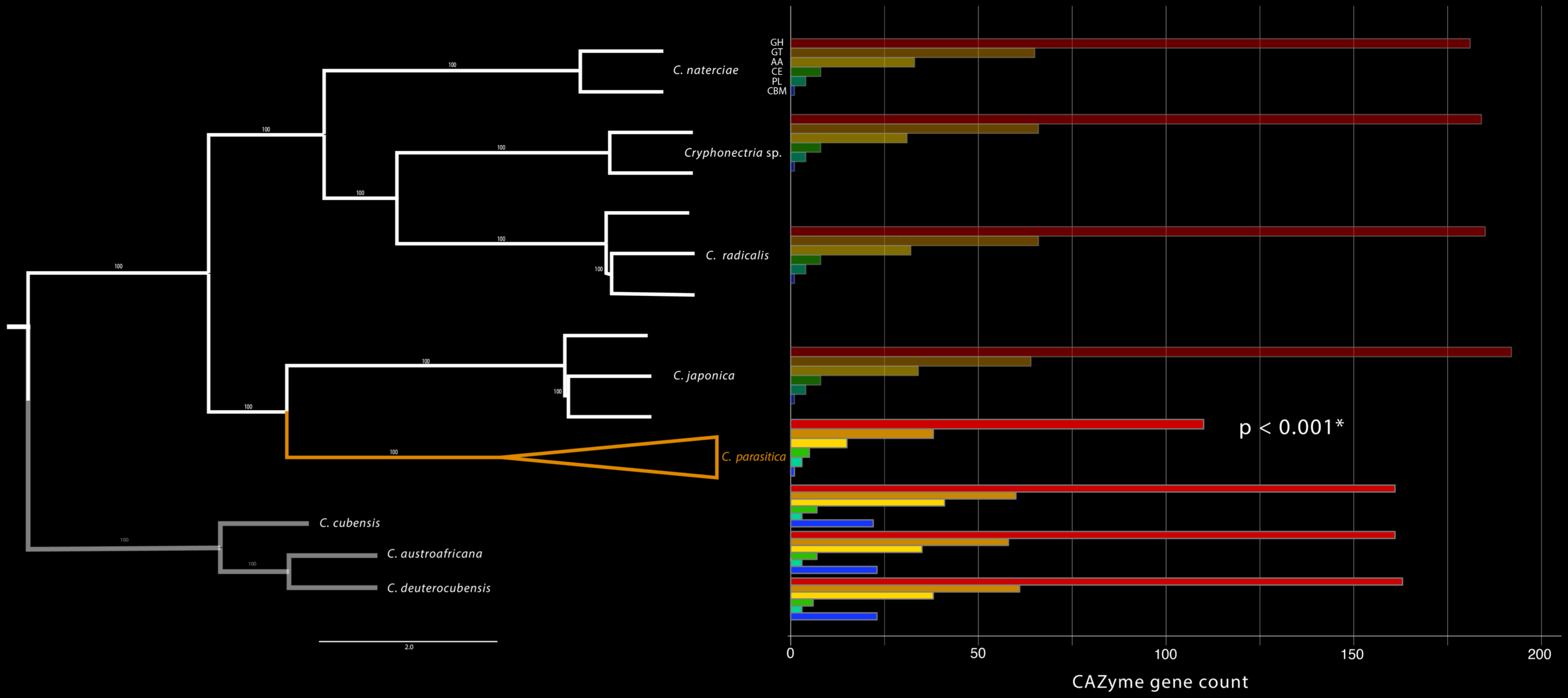
Cell wall degrading enzymes



Cell wall degrading enzymes

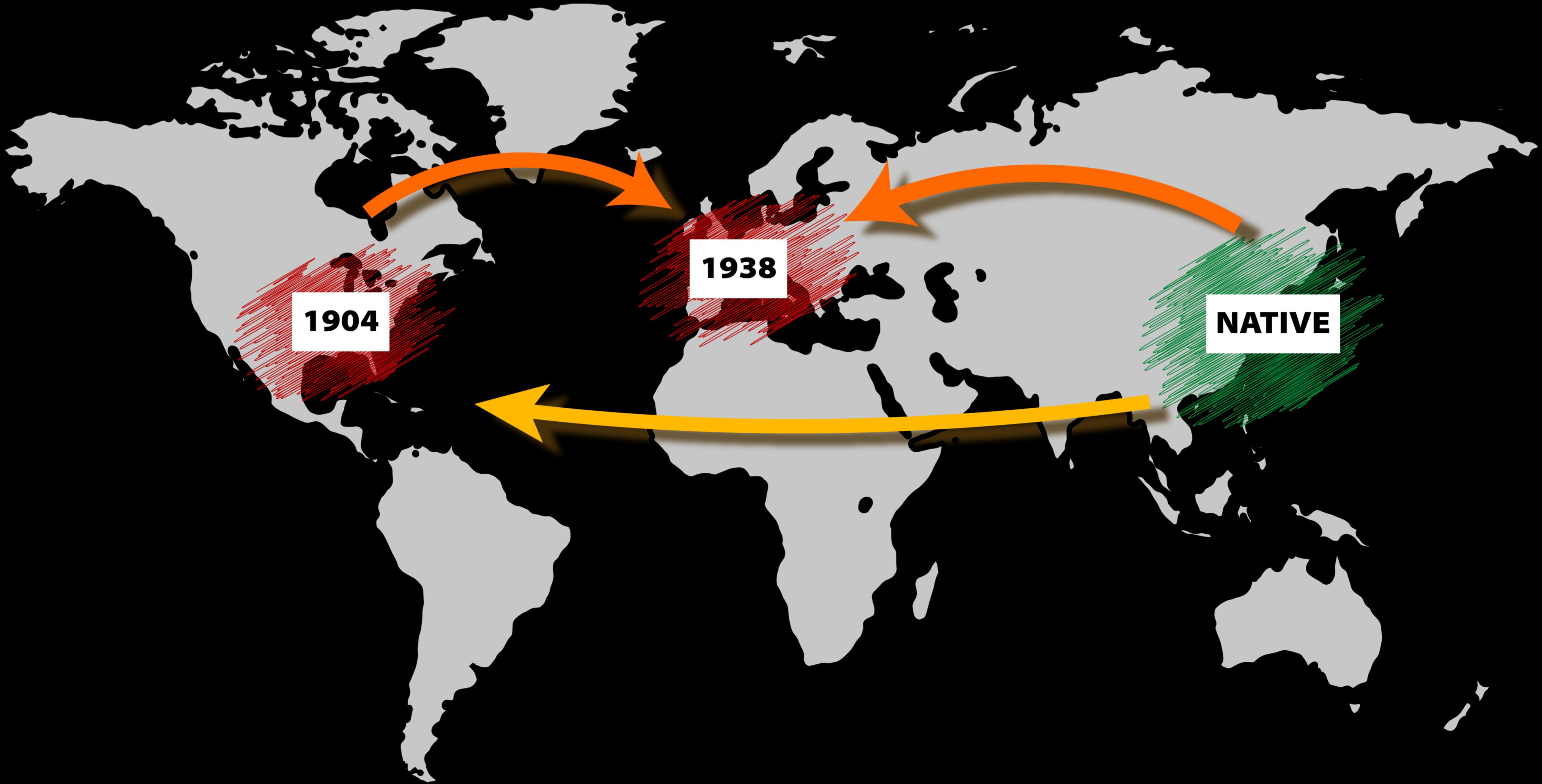


Cell wall degrading enzymes



Emergence & diversification of a highly invasive lineage

The chestnut blight invasion



Low diversity in south-eastern Europe

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- <u>vc type</u>: EU-12

Low diversity in south-eastern Europe

- vc type: EU-12
- Mating type: MAT-1

Low diversity in south-eastern Europe

- <u>vc type</u>: EU-12
- <u>Mating type:</u> MAT-1
- **S12 lineage = ”clonal”**

What we don’t know about S12…

Origin?

What we don’t know about S12…

Origin?

Diversity in S12?

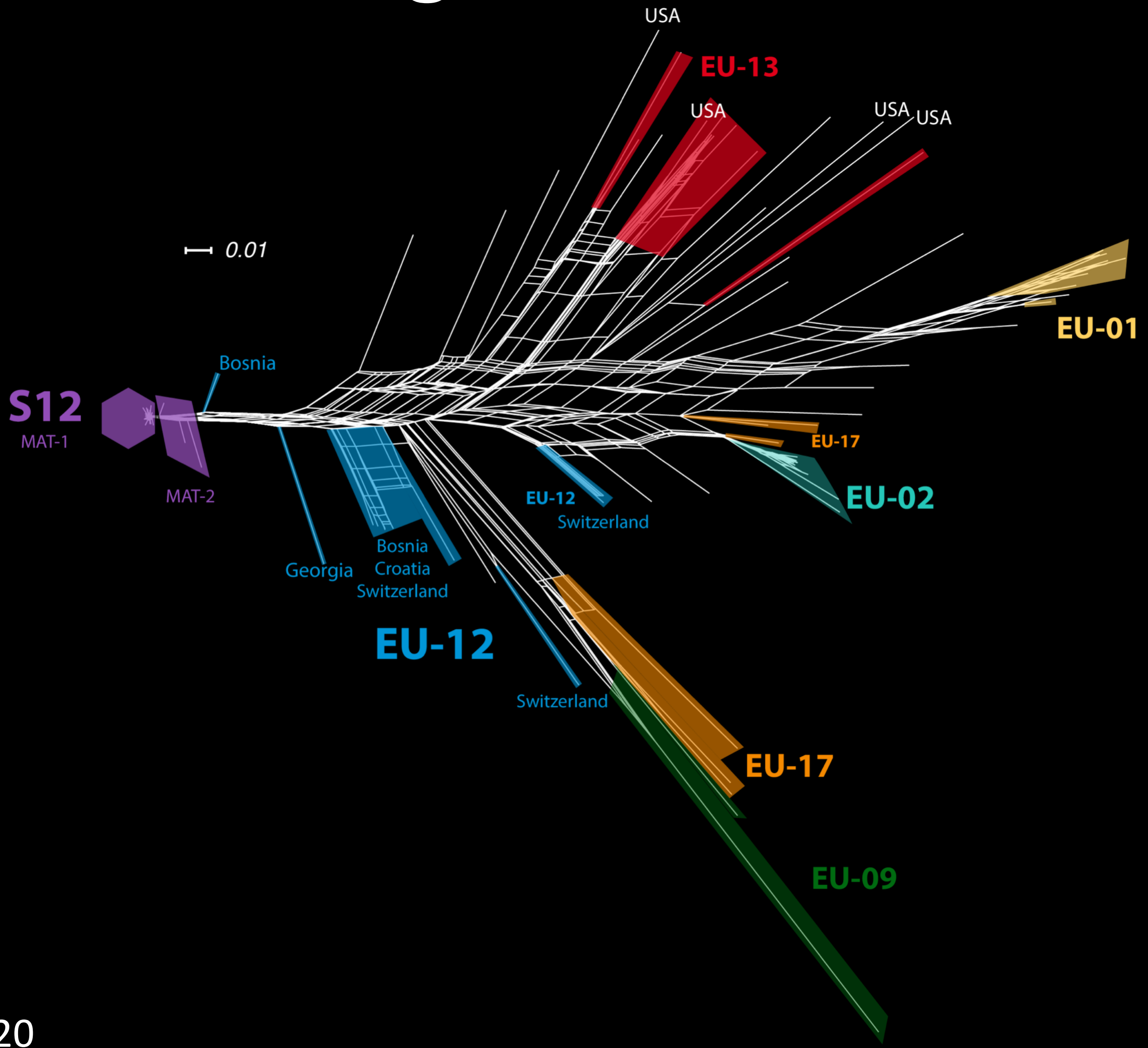
What we don’t know about S12…

Origin?

Diversity in S12?

Evidence for adaptive evolution?

Origin of S12



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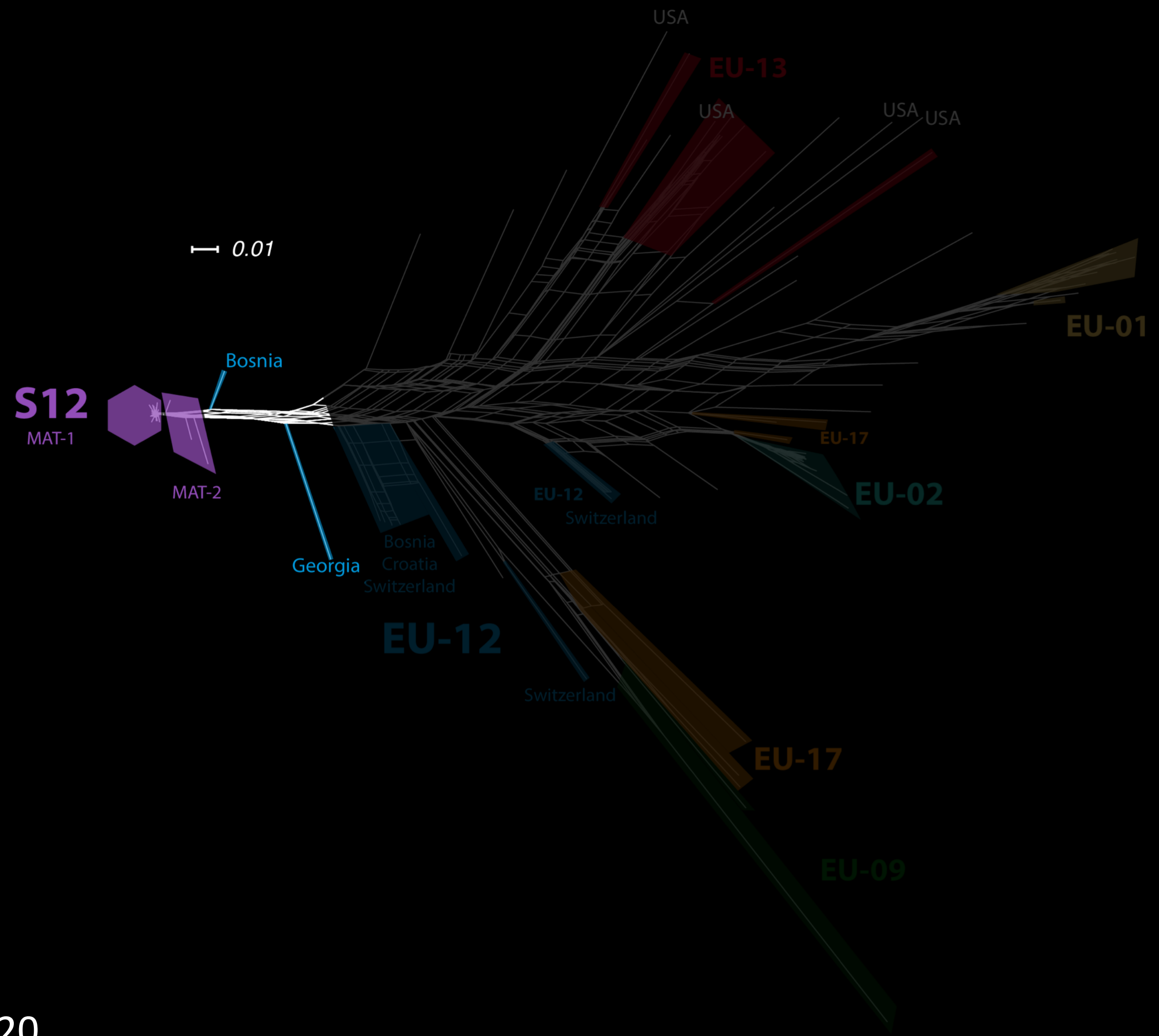
Origin of S12



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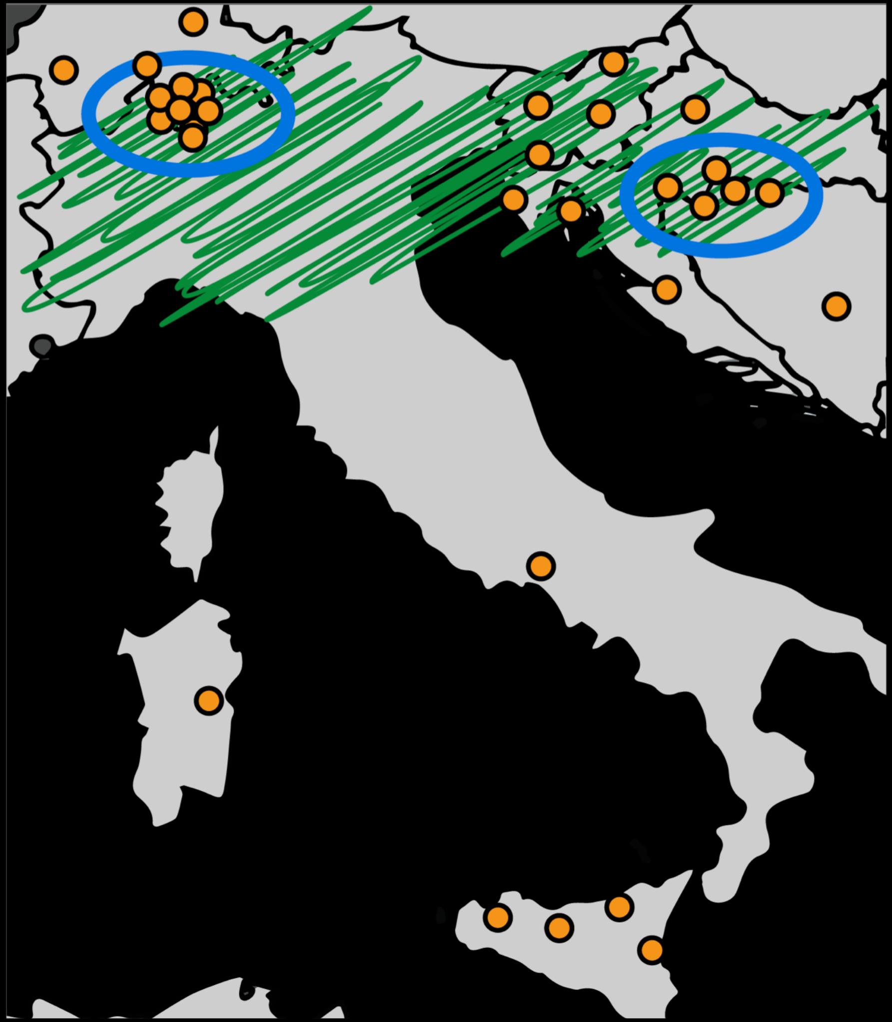
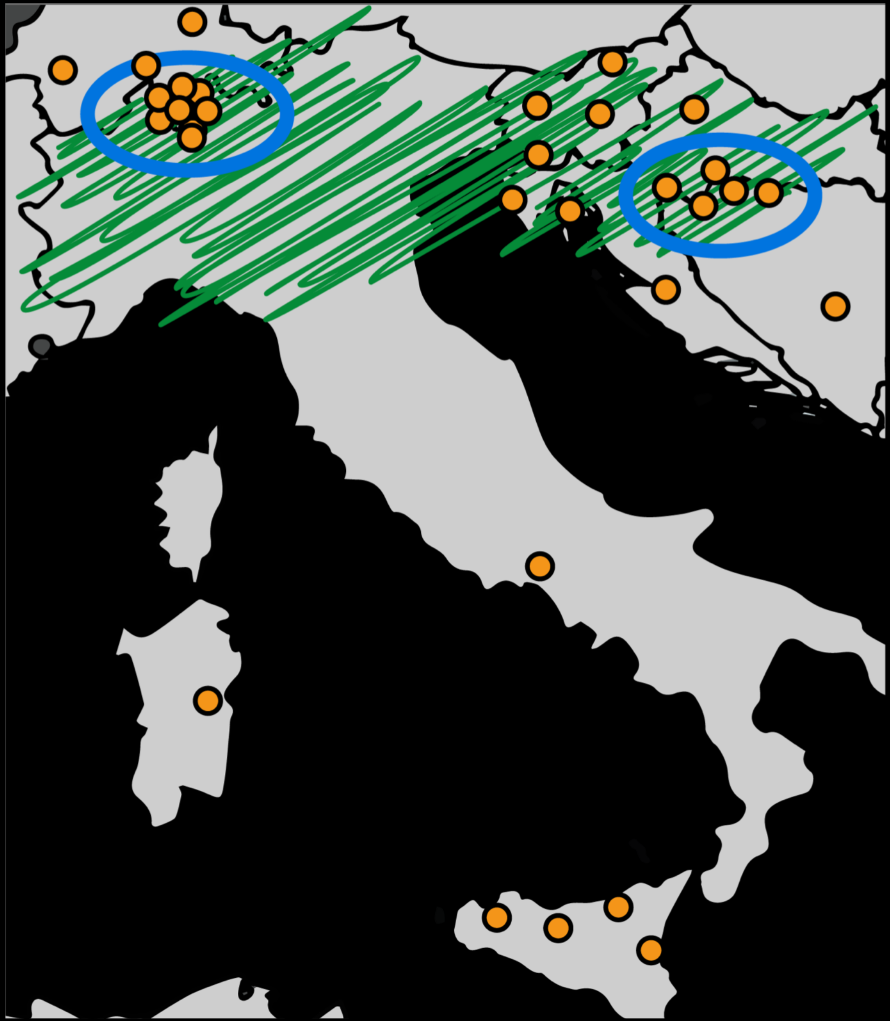
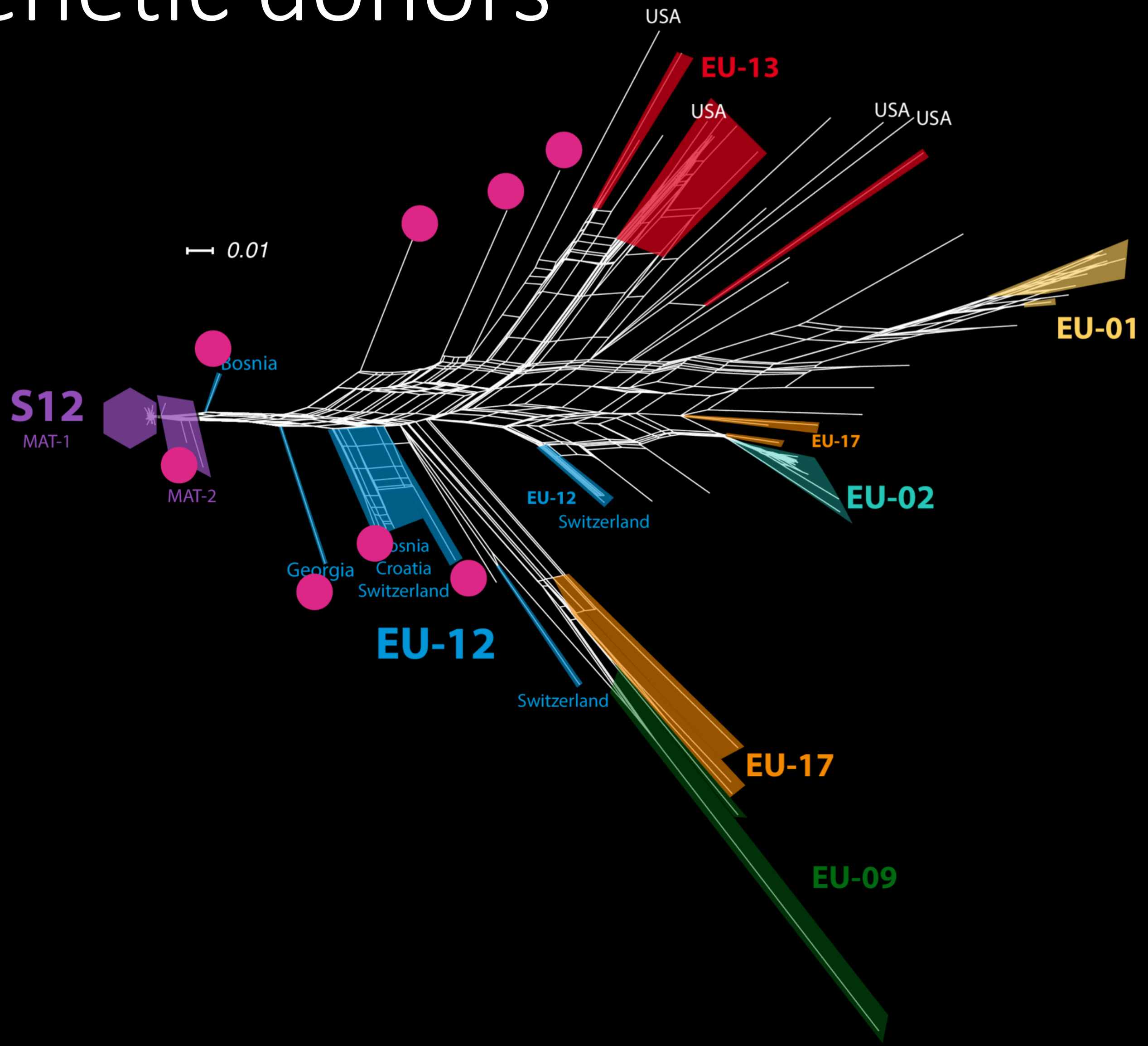
S12 - genetic donors

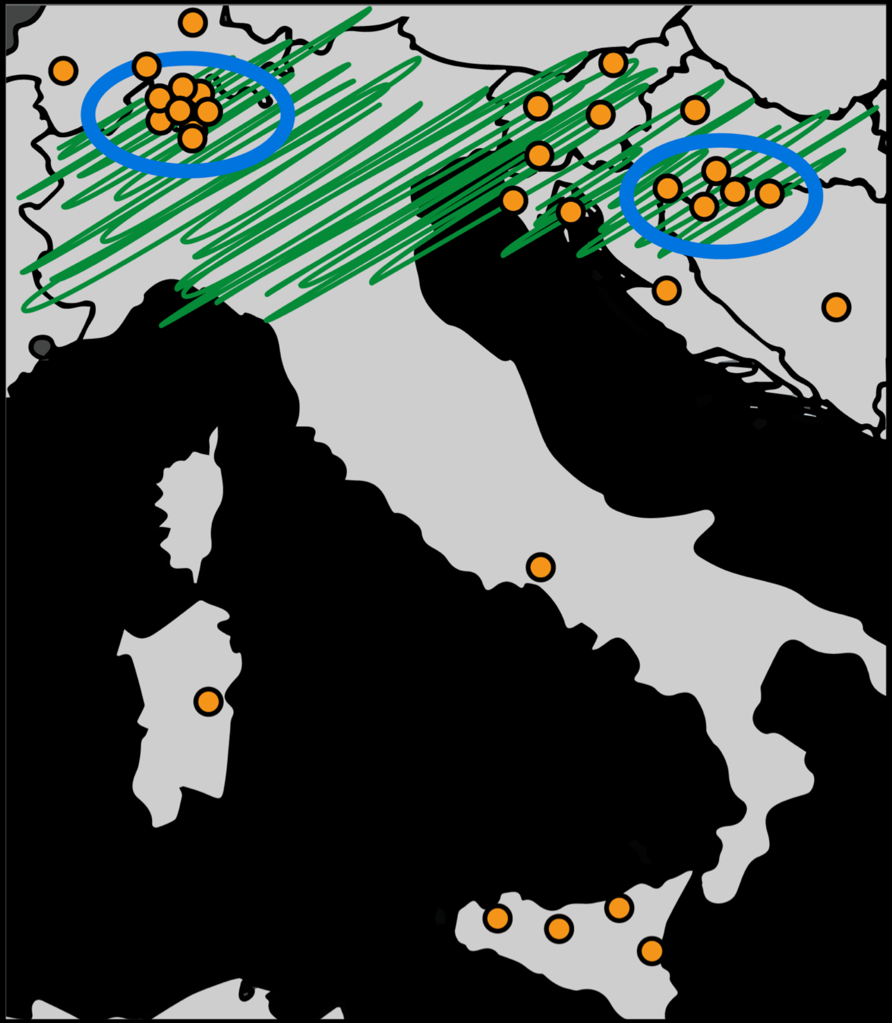


S12 - genetic donors



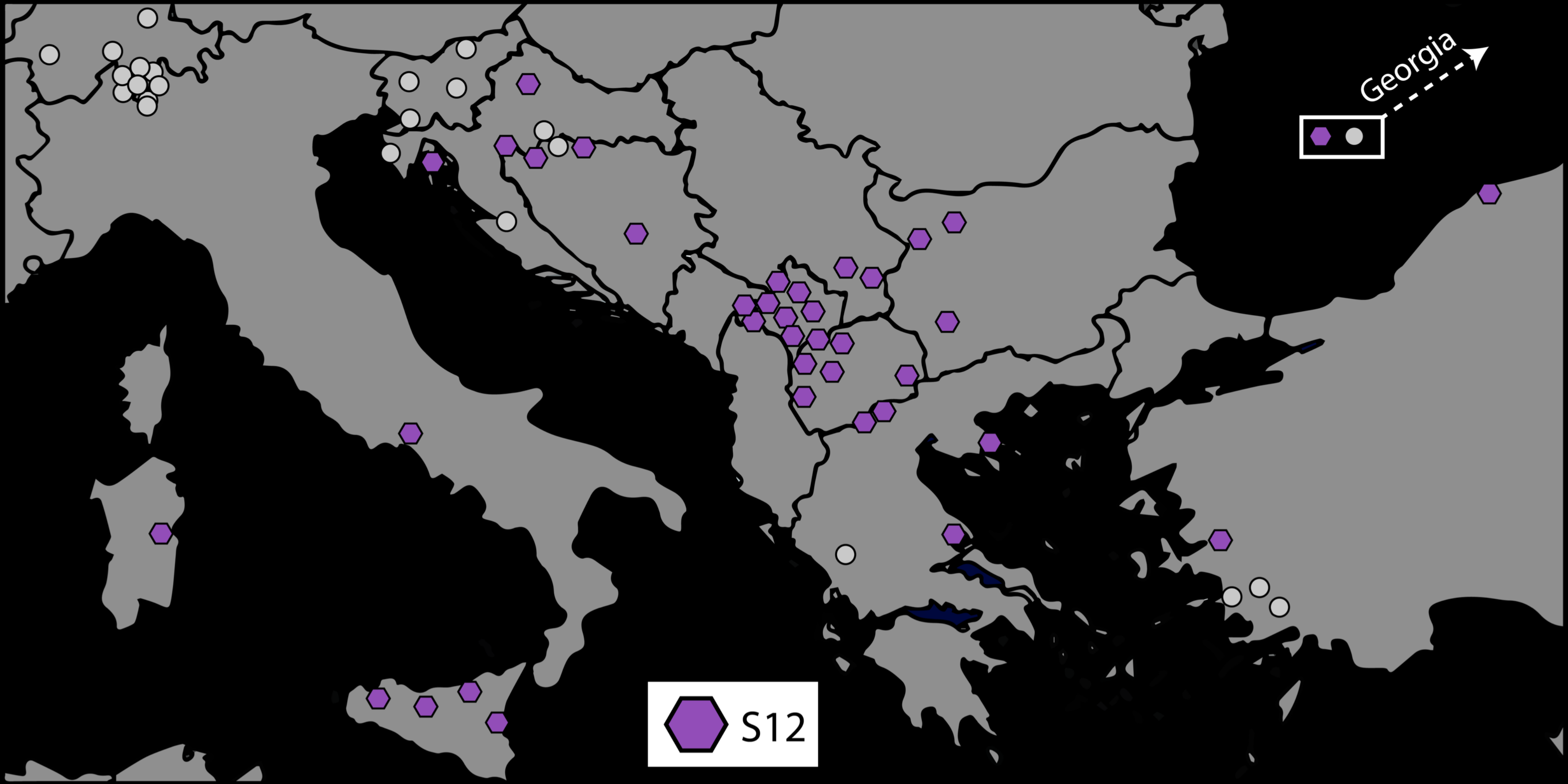


Origin of S12

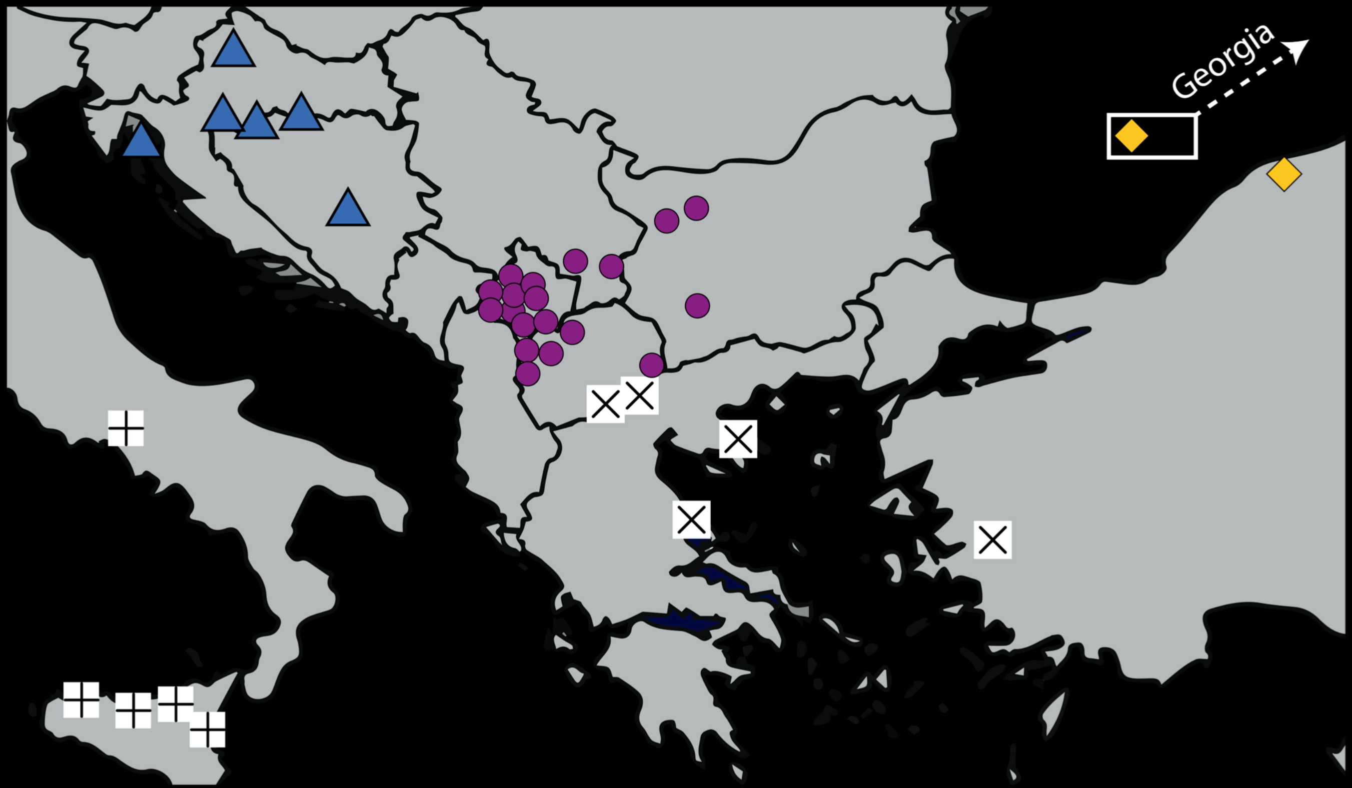


Likely origin of S12 in northern Italy

Diversity in a “clonal lineage”



Diversity in a “clonal lineage”



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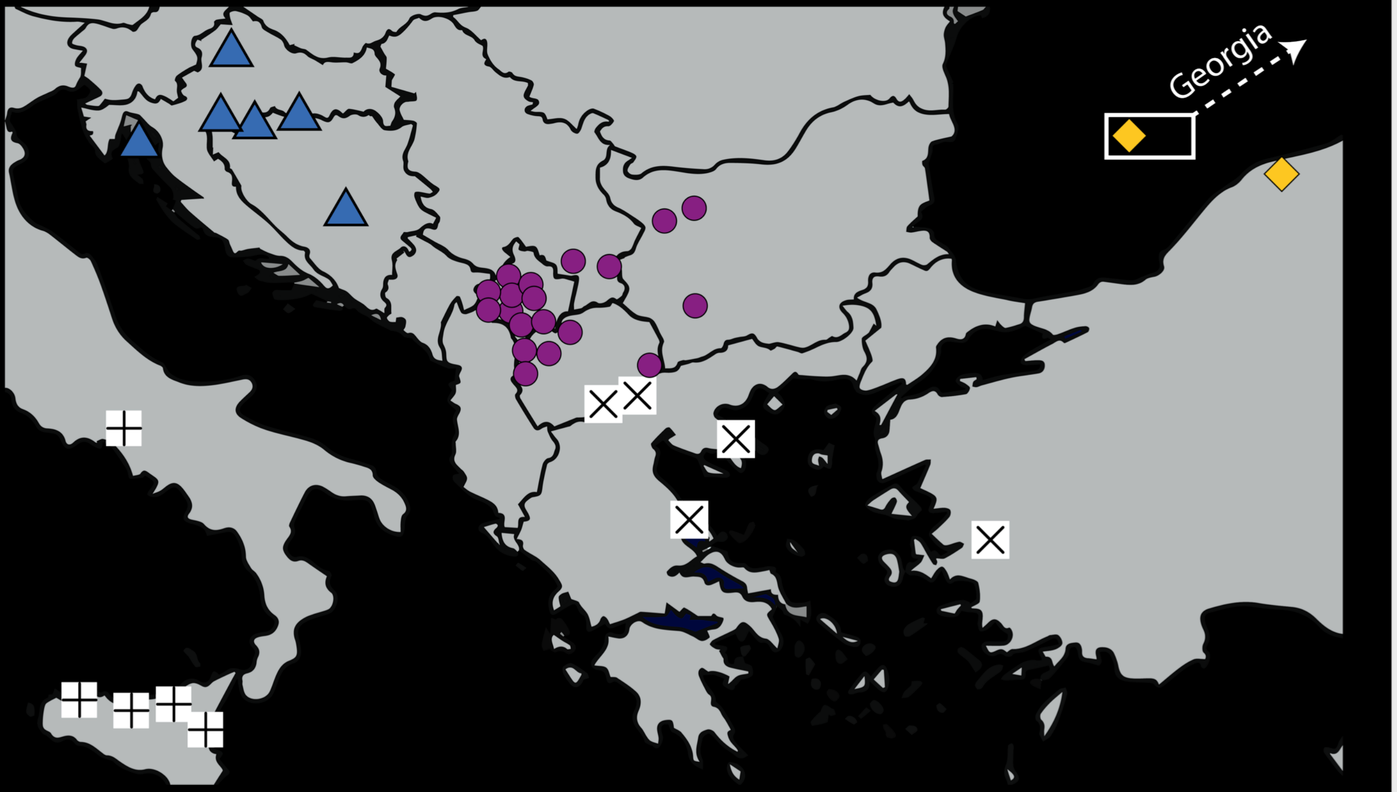
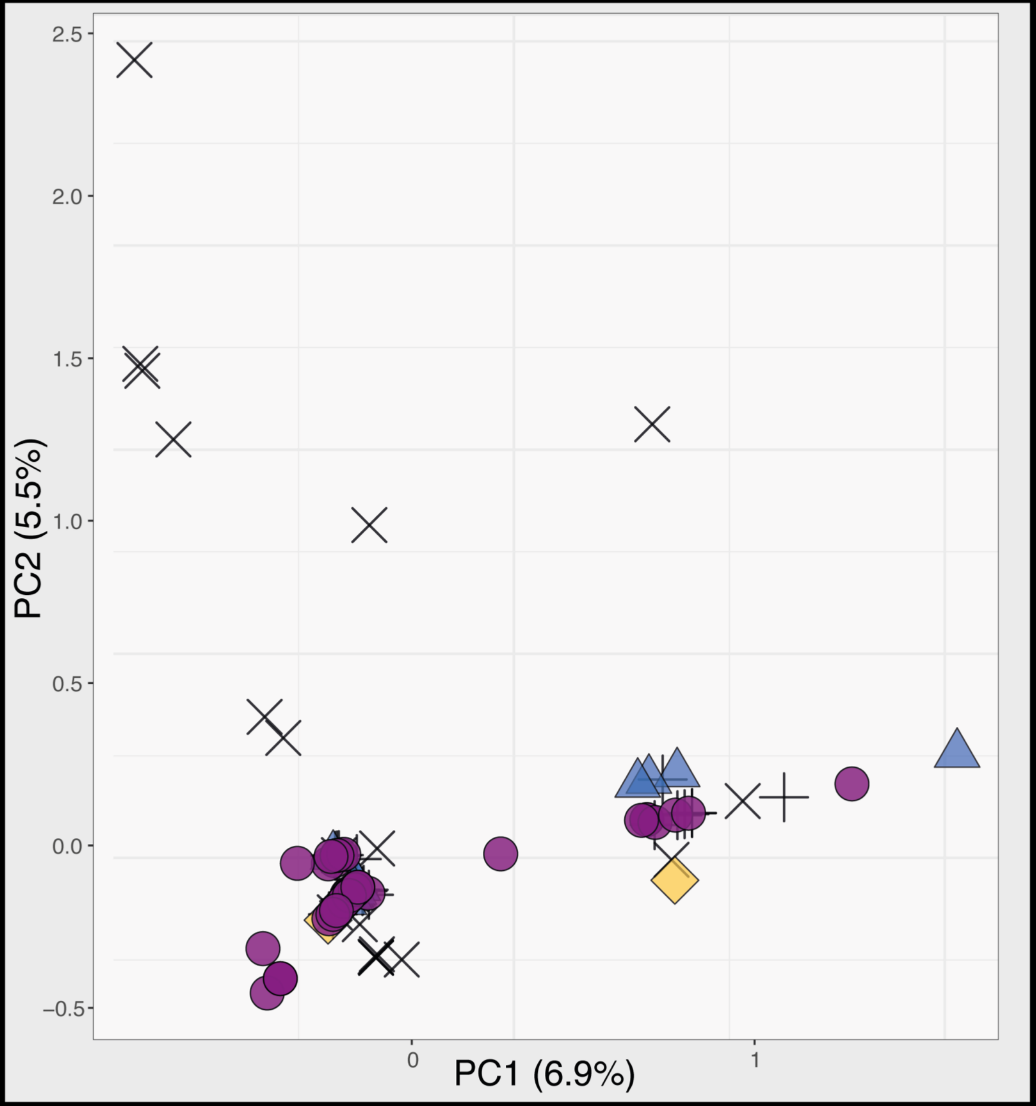
Diversity in a “clonal lineage”





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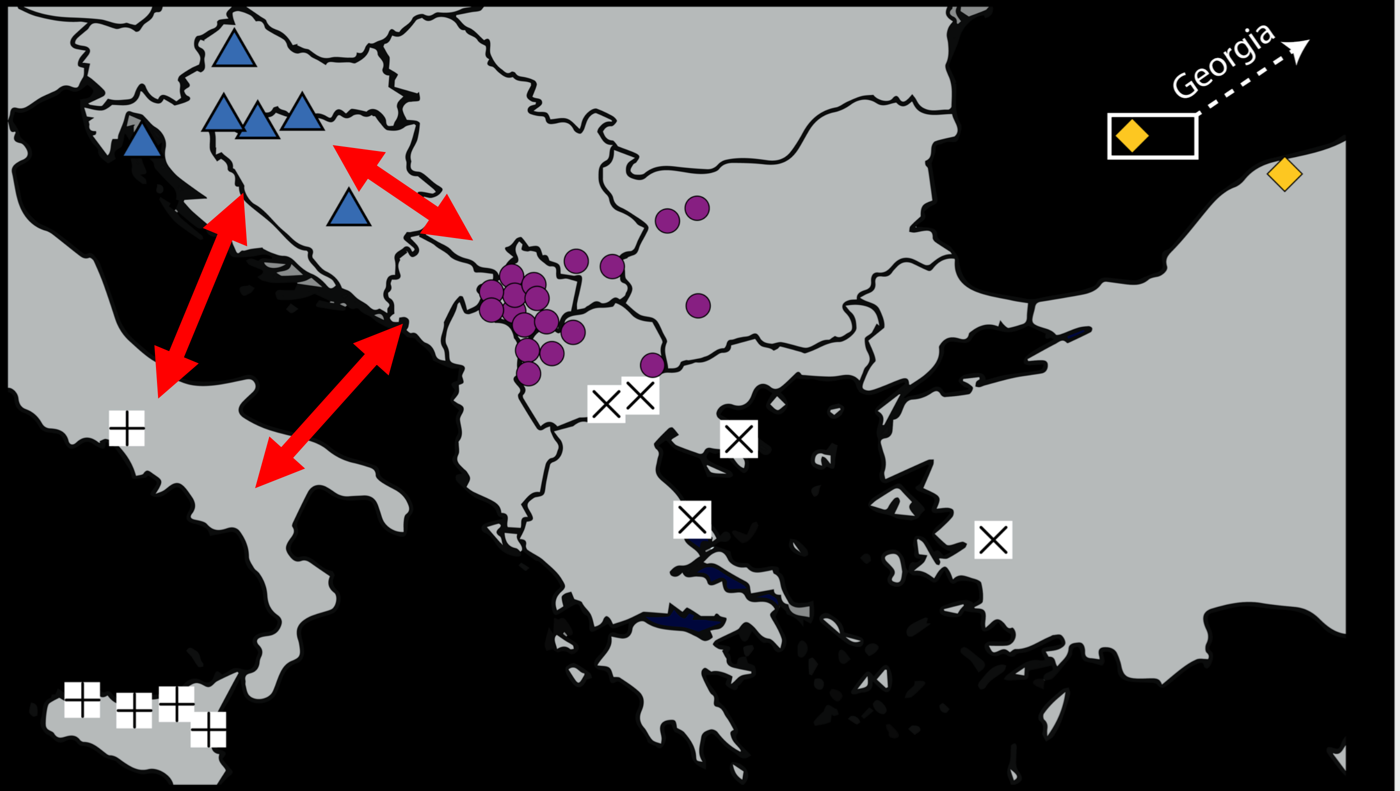
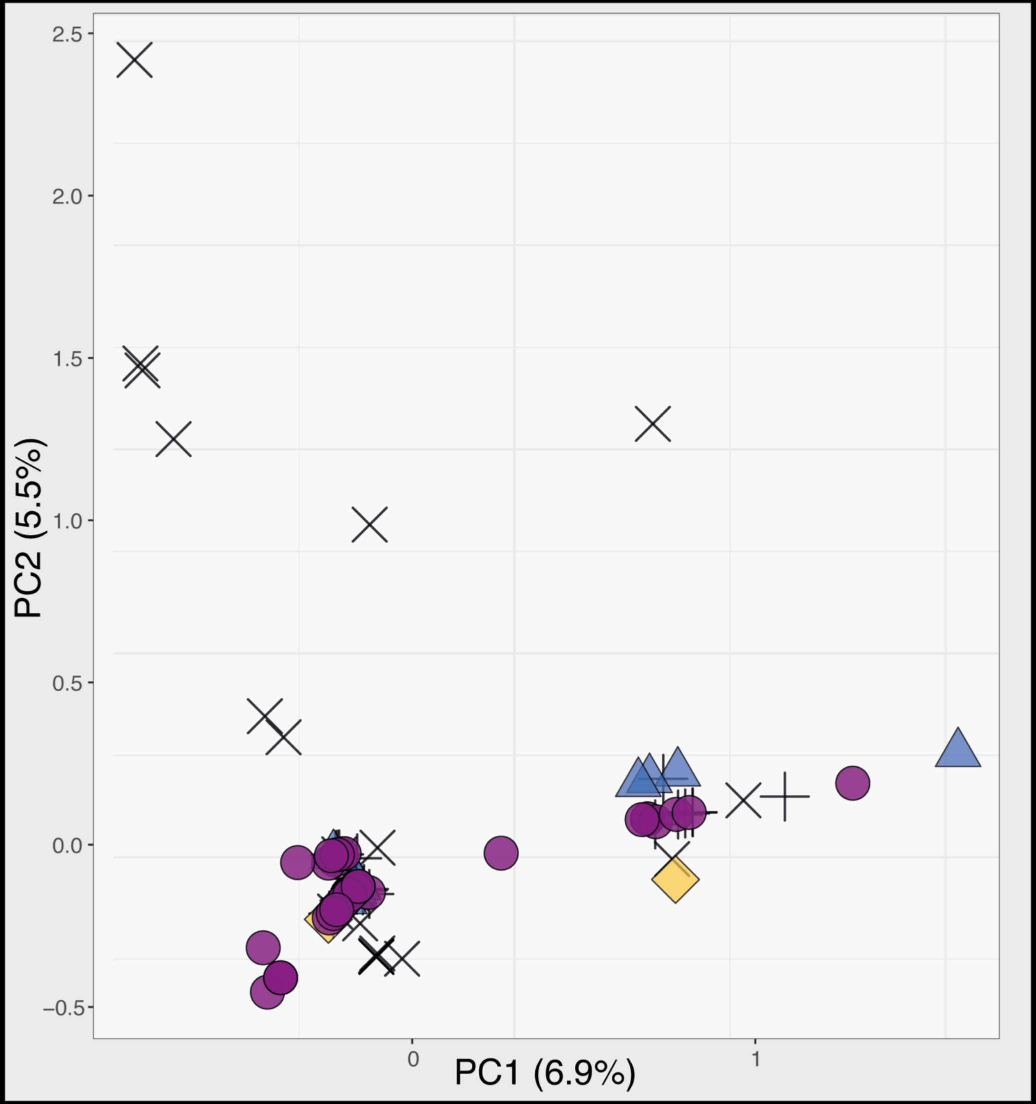
Genetic drift & human trade





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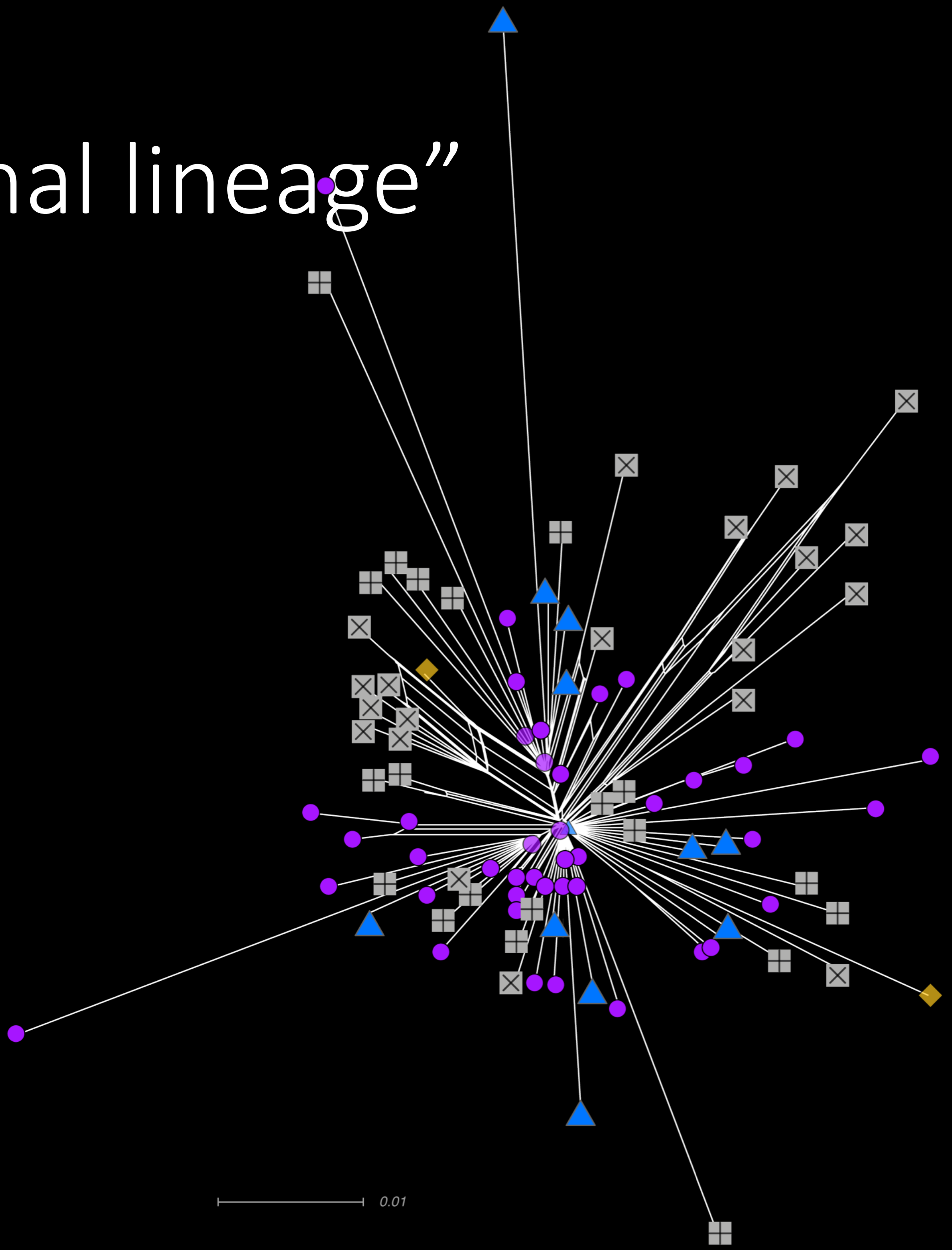
Diversity in a “clonal lineage”

- Mutation accumulation (~85% singletons!)



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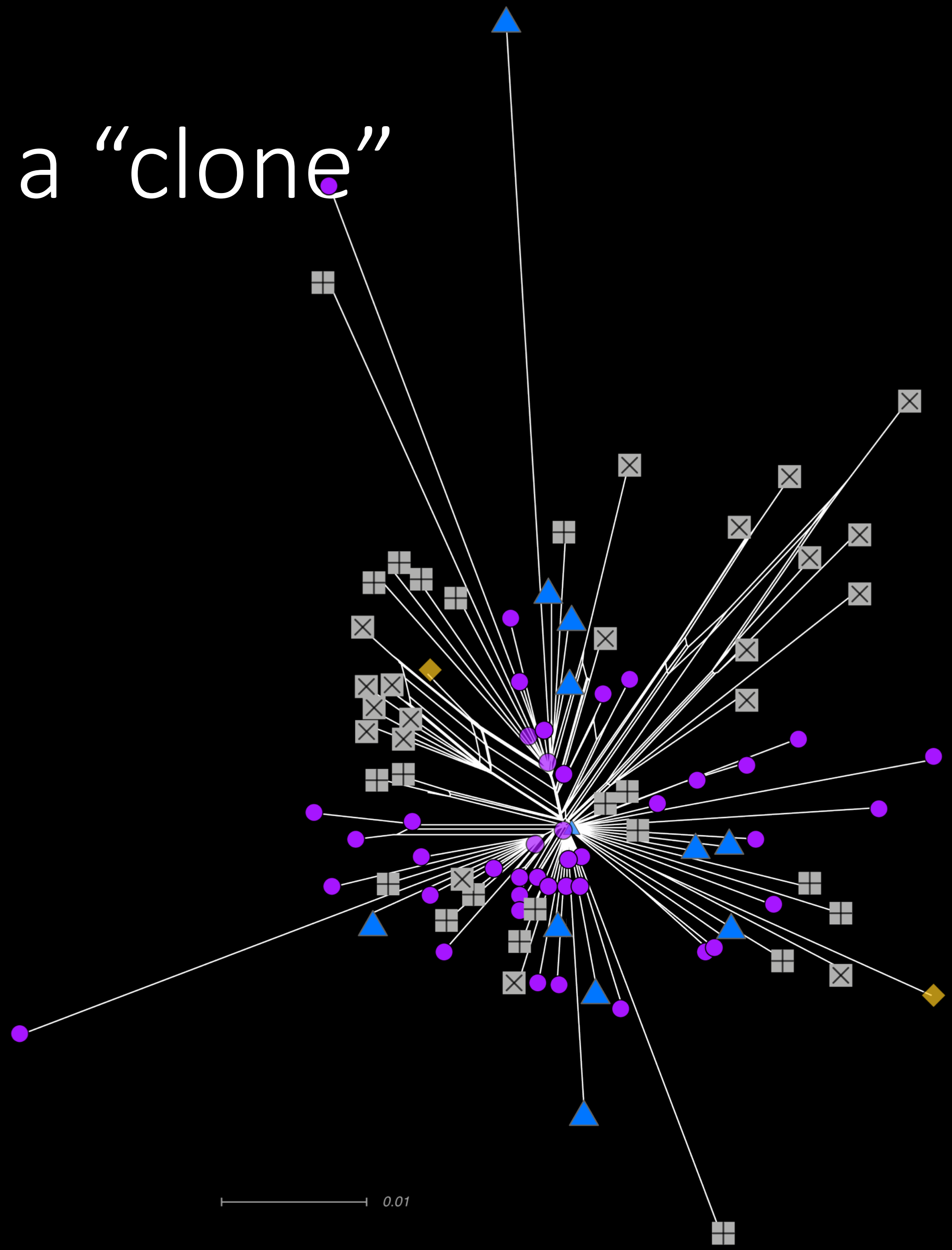
Recombination in a “clone”

- Mutation accumulation (~85% singletons!)
- Recombination (PHI: p=0.0035**)



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Recombination in a “clone”

- Mutation accumulation (~85% singletons!)
- Recombination (PHI: $p=0.0035^{**}$)

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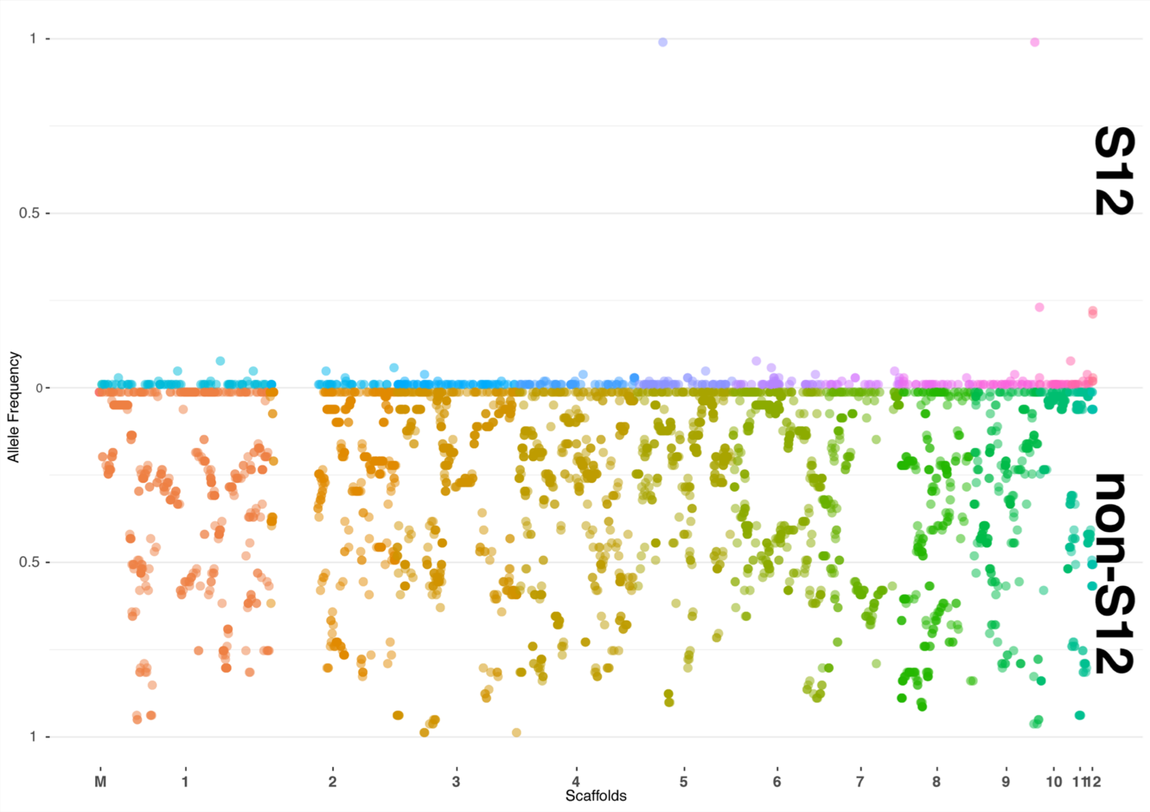
Purifying selection within lineage

- Mutation accumulation (~85% singletons!)
- Recombination (PHI: p=0.0035**)
- Few deleterious mutations



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Origin European (Italian) bridgehead

Origin	European (Italian) bridgehead
Diversity	no geography, mutation accumulation

Origin	European (Italian) bridgehead
Diversity	no geography, mutation accumulation
Evolution	• Purifying selection • clonality advantageous? • Recombination possible!

Thanks to...

Simone Prospero (Swiss Federal Research Institute WSL)

Daniel Croll (University of Neuchâtel)

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Genetic Diversity Centre Zurich (GDC)

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