Applying a Novel Bioinformatic Method to Study Plant Evolution

Christina Shehata

What questions interest plant biologists?

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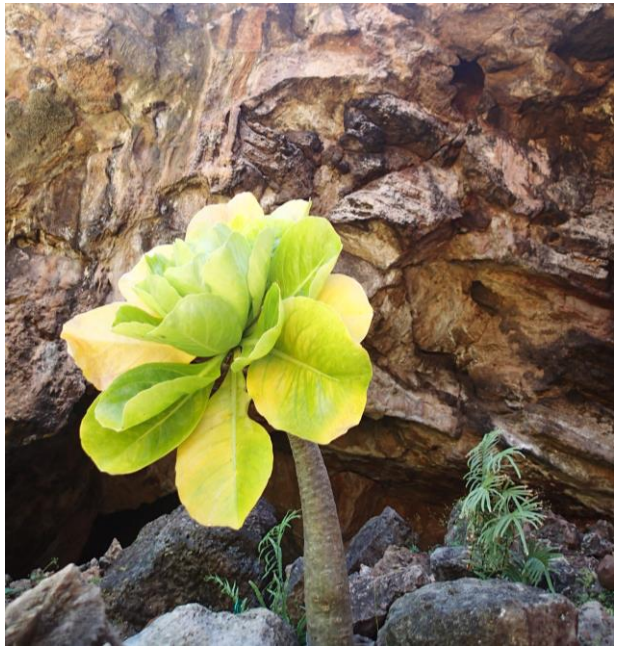
Conservation

How can we reintroduce endangered individuals into the environment?



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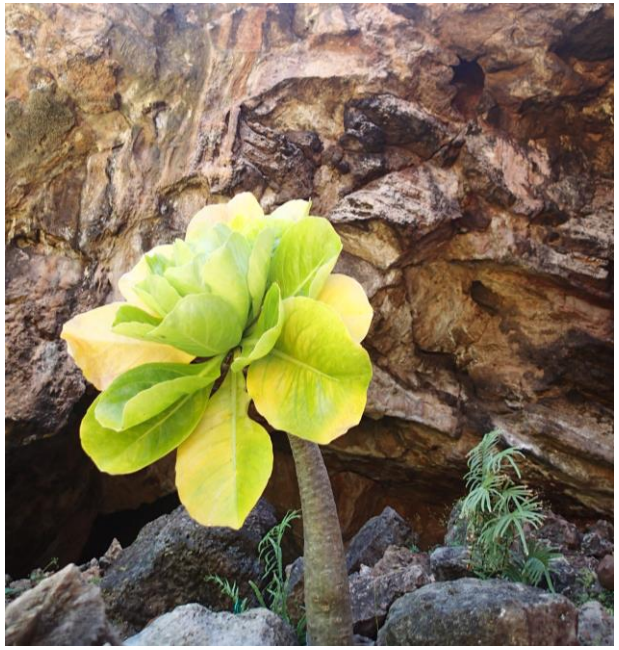


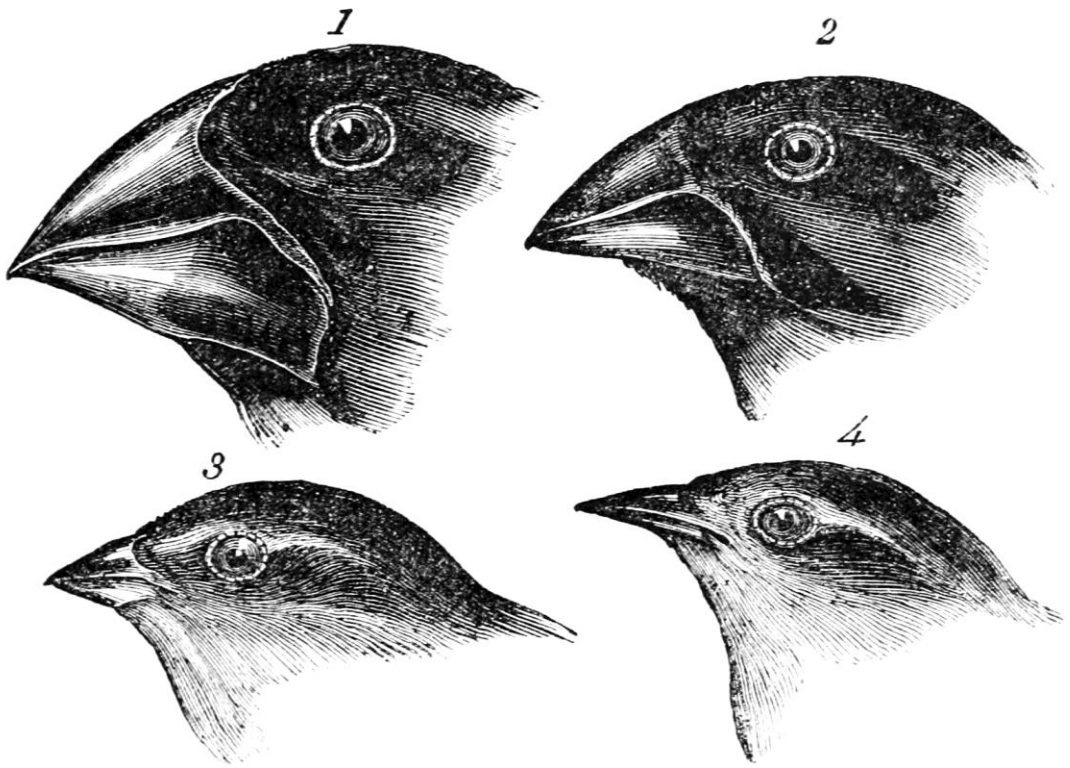
Improving Cultivars

How can we grow the best crops possible?

What questions interest plant biologists?

Charles Darwin

Natural selection on beak size

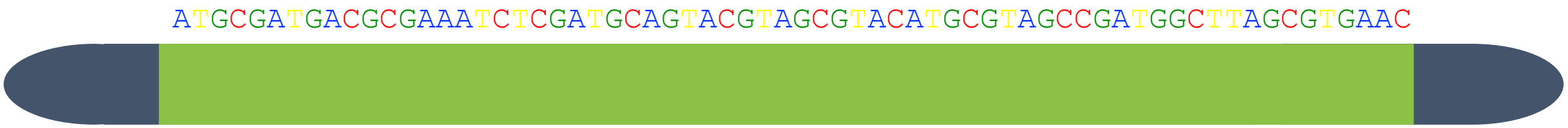


1. Geospiza magnirostris.
2. Geospiza fortis.
3. Geospiza parvula.
4. Certhidea olivacea.

Many selection detection methods rely on whole-genome data sets

The data we need

Many selection detection methods rely on whole-genome data sets



The data we need

Many selection detection methods rely on whole-genome data sets

ATGCGATGACGCGAAATCTCGATGCAGTACGTAGCGTACATGCGTAGCCGATGGCTTAGCGTGAAC

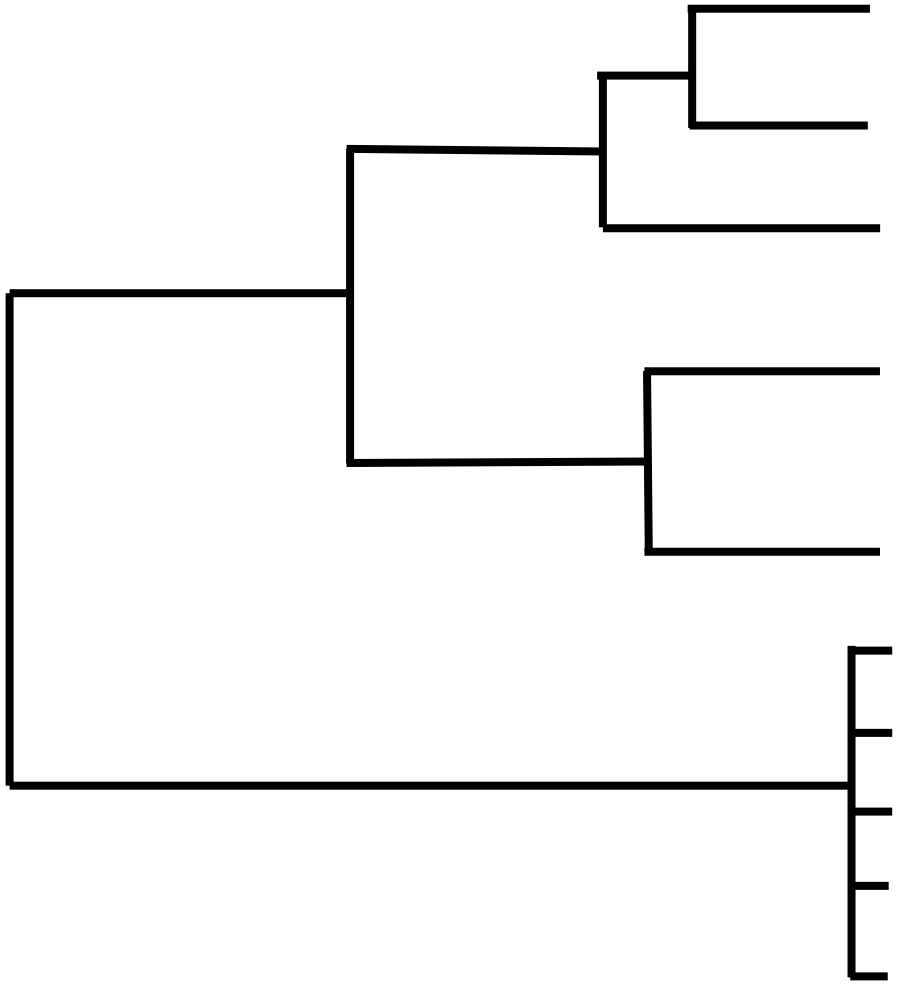
The data we need

The data we have

LSD detects signatures of selection along the branches of a population tree (phylogeny)

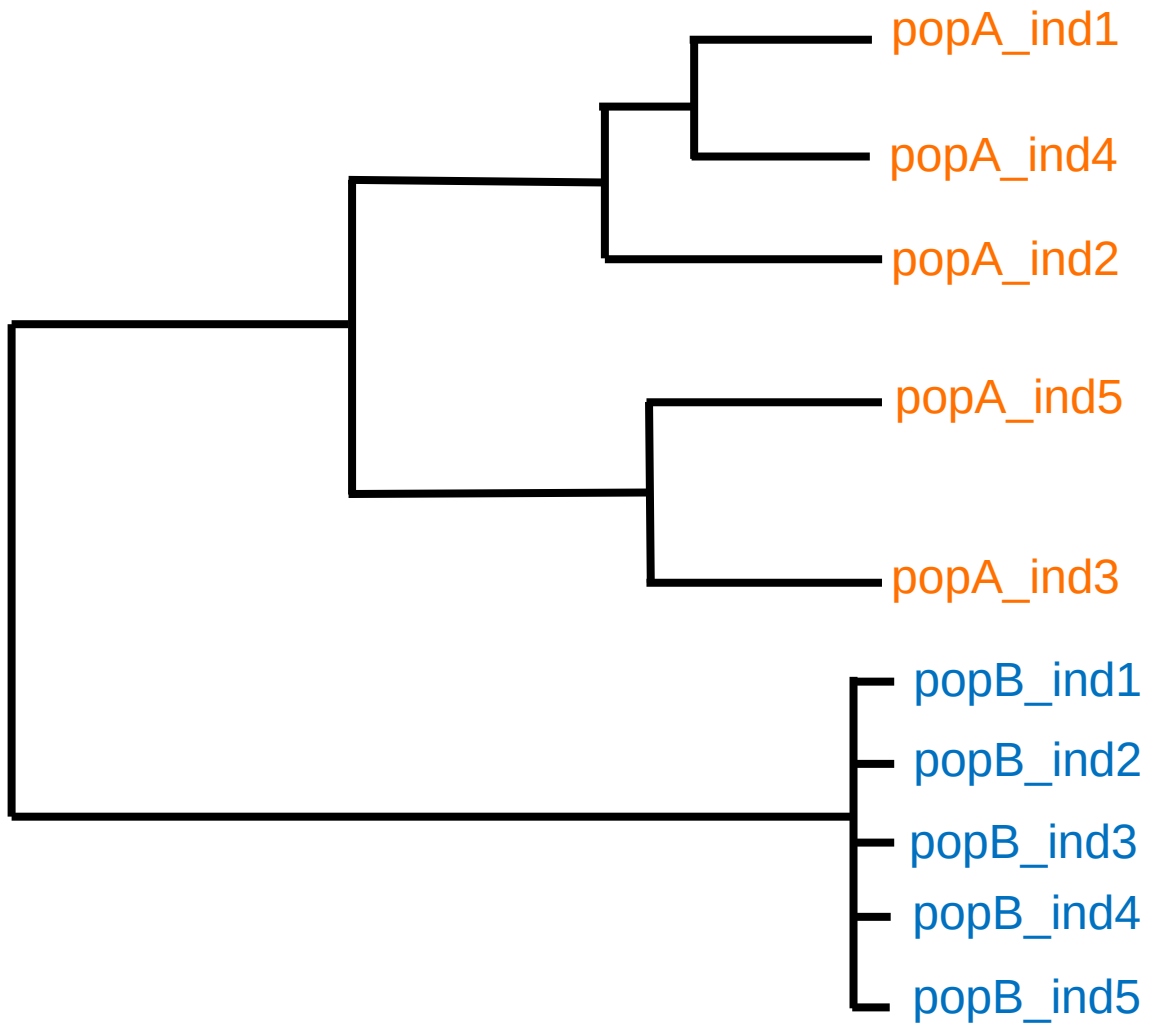
≠ Levels of Exclusively Shared Difference (LSD)

LSD detects signatures of selection along the branches of a population tree (phylogeny)



Adapted from Librado and Orlando (2018)

LSD detects signatures of selection along the branches of a population tree (phylogeny)



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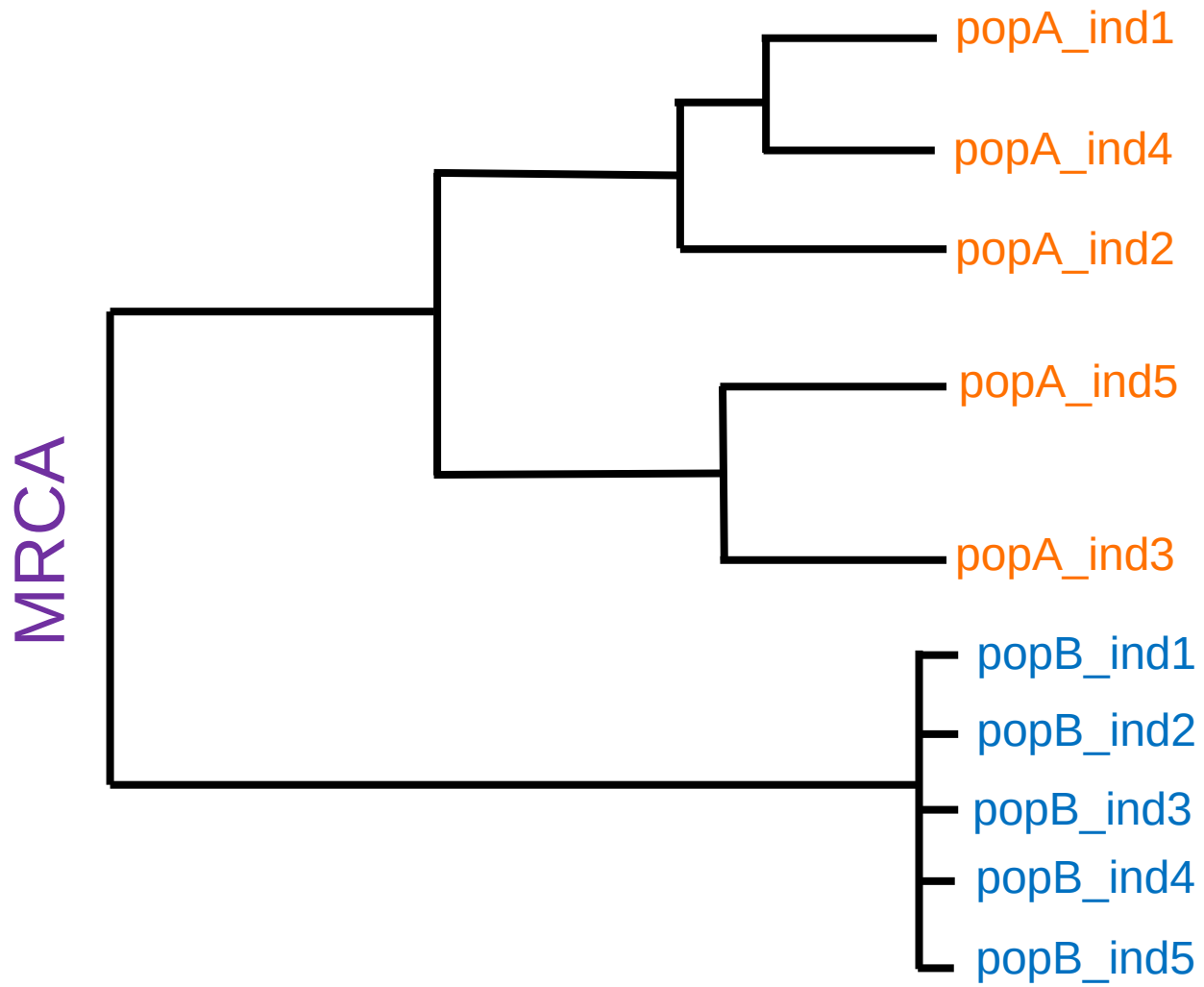

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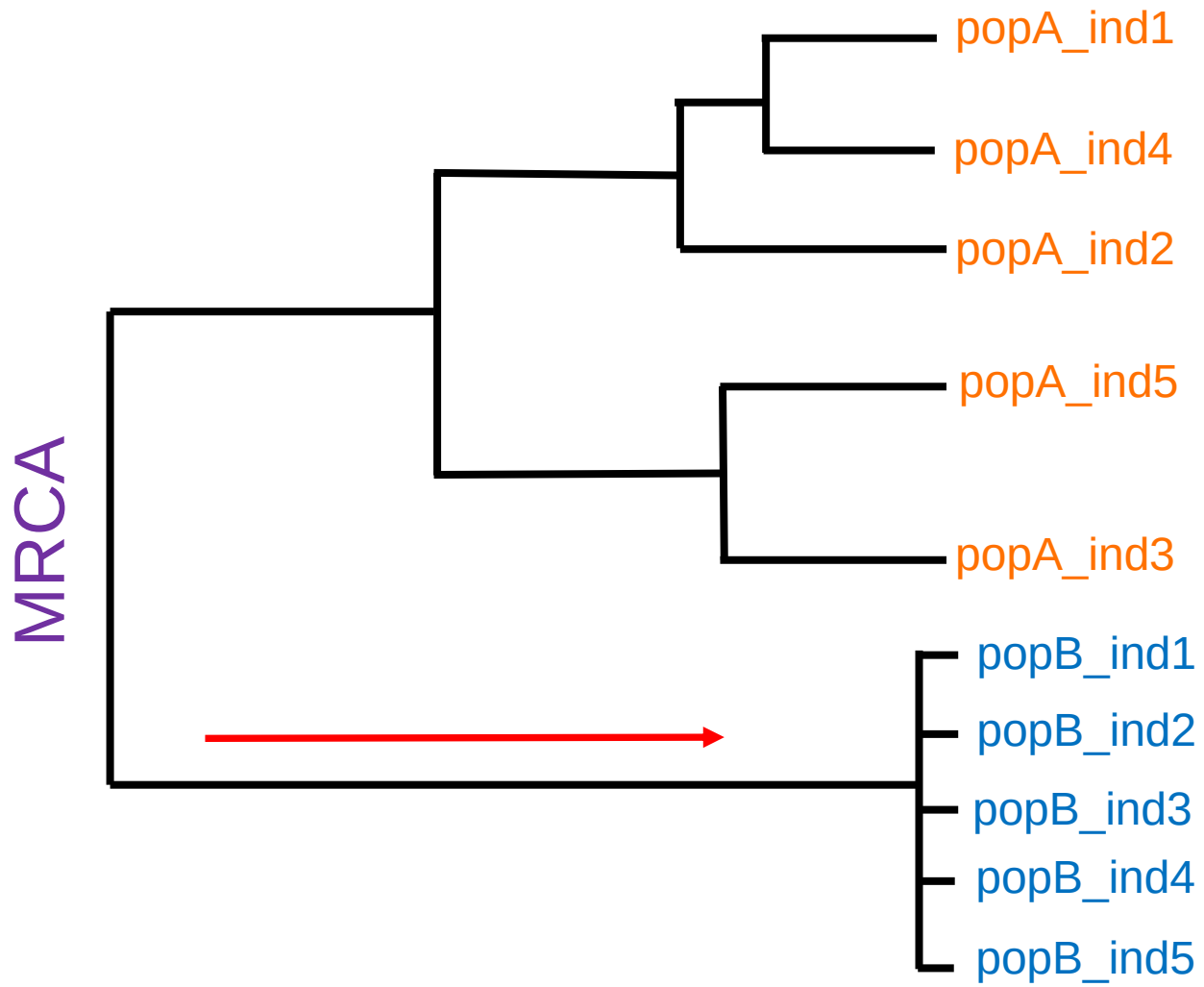

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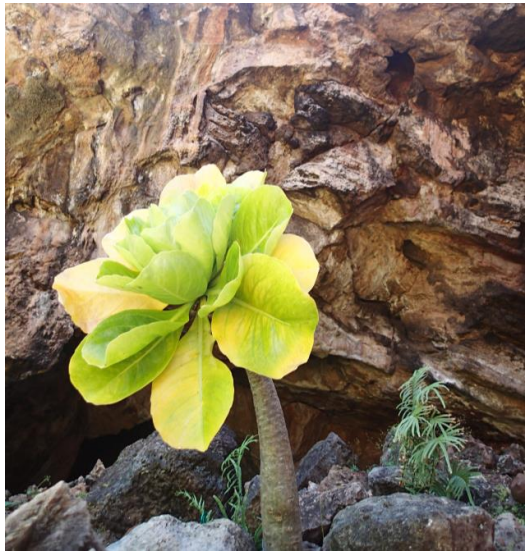
Looking for functional genetic variation to reintroduce genetically diverse individuals to the wild



Brighamia insignis
(Cabbage on a Stick)

Improving Cultivars

Identifying genes underlying the traits of superior crop varieties

LSD can identify candidate genes under selection in discrete gene data sets

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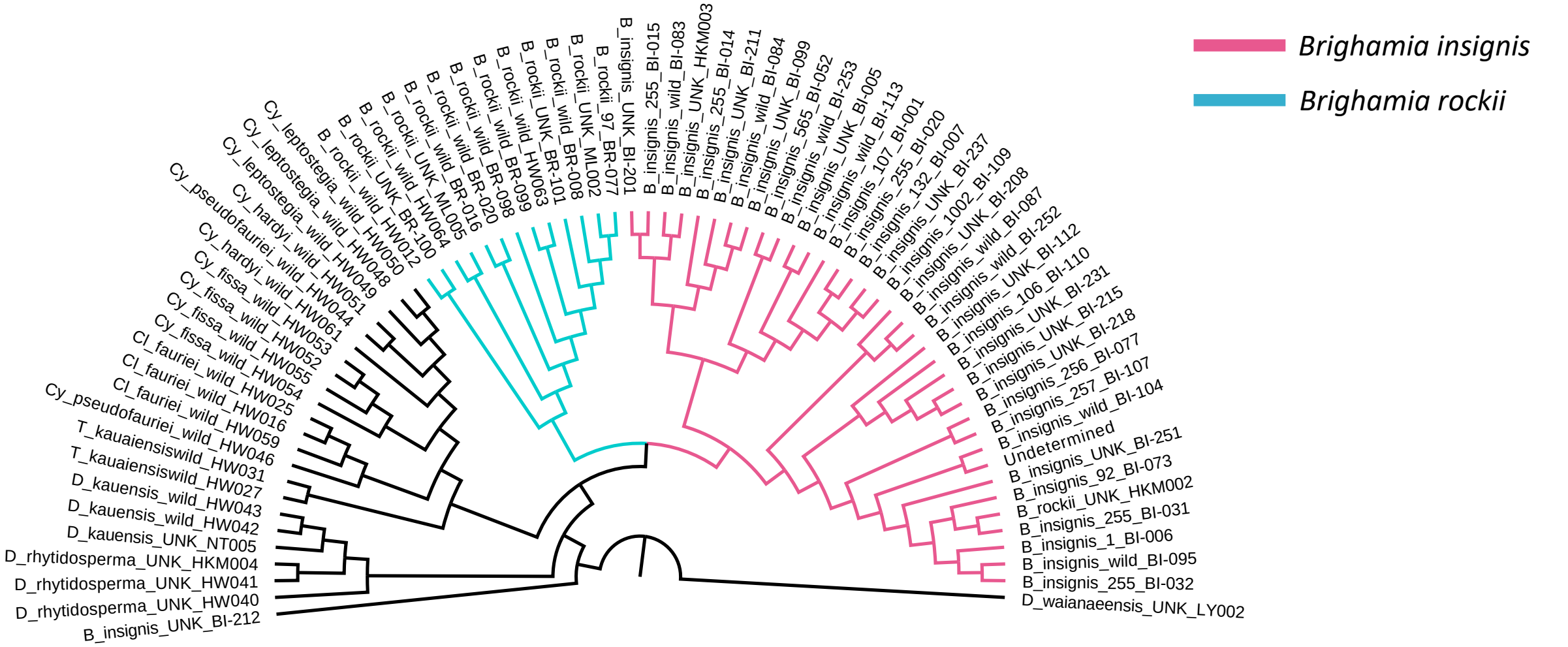

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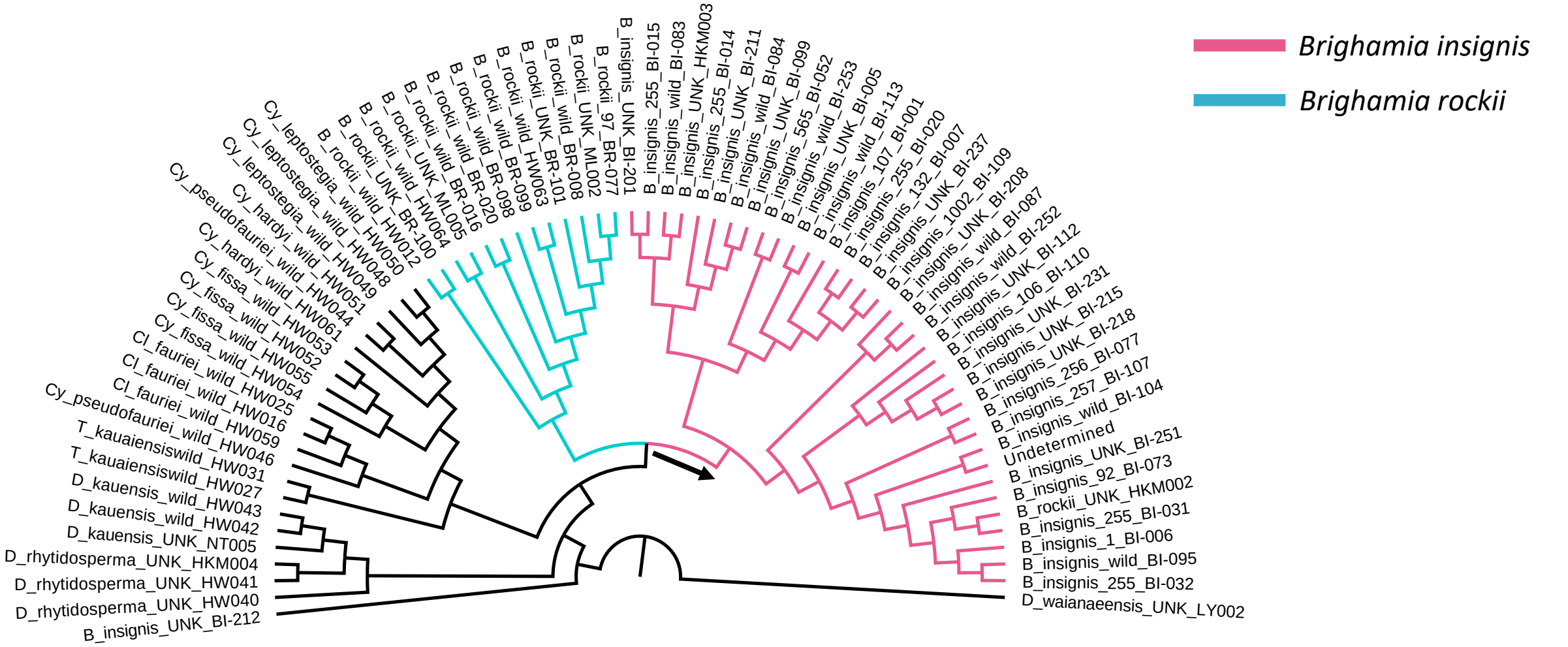

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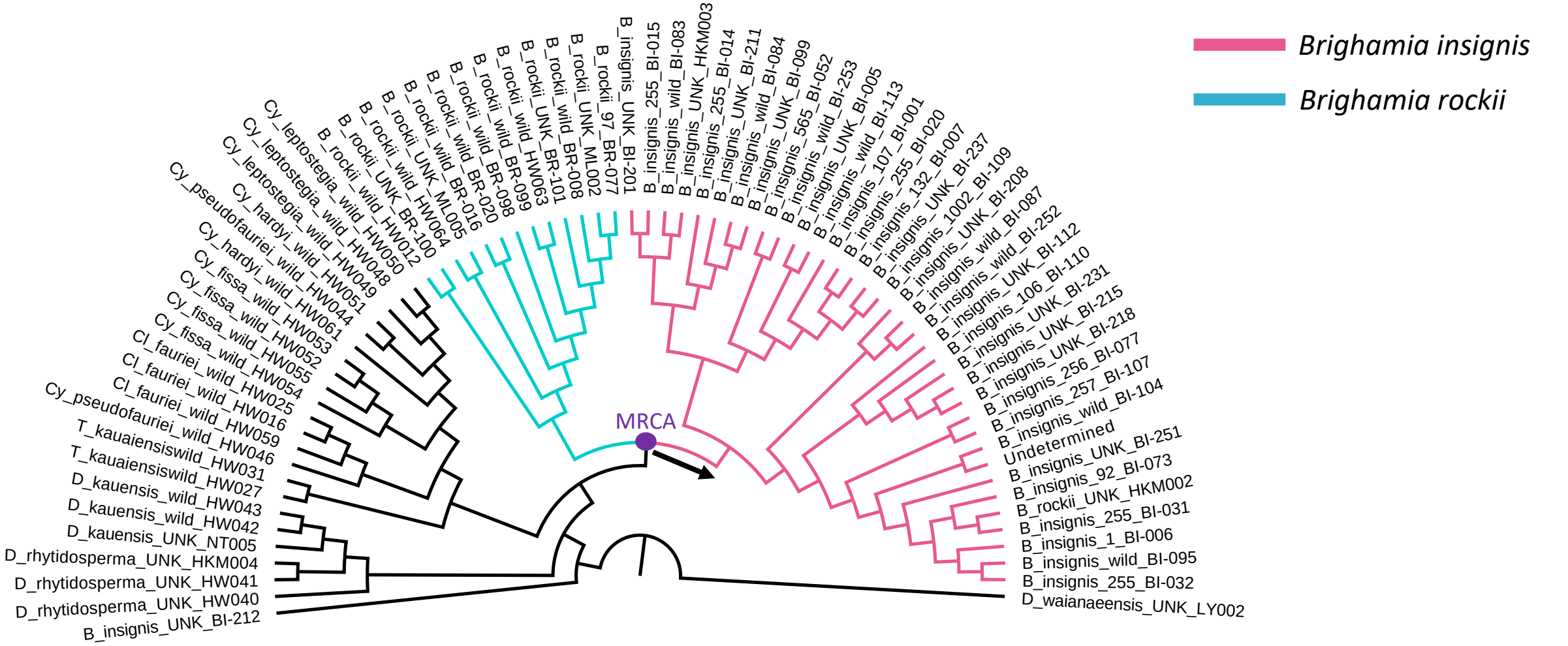

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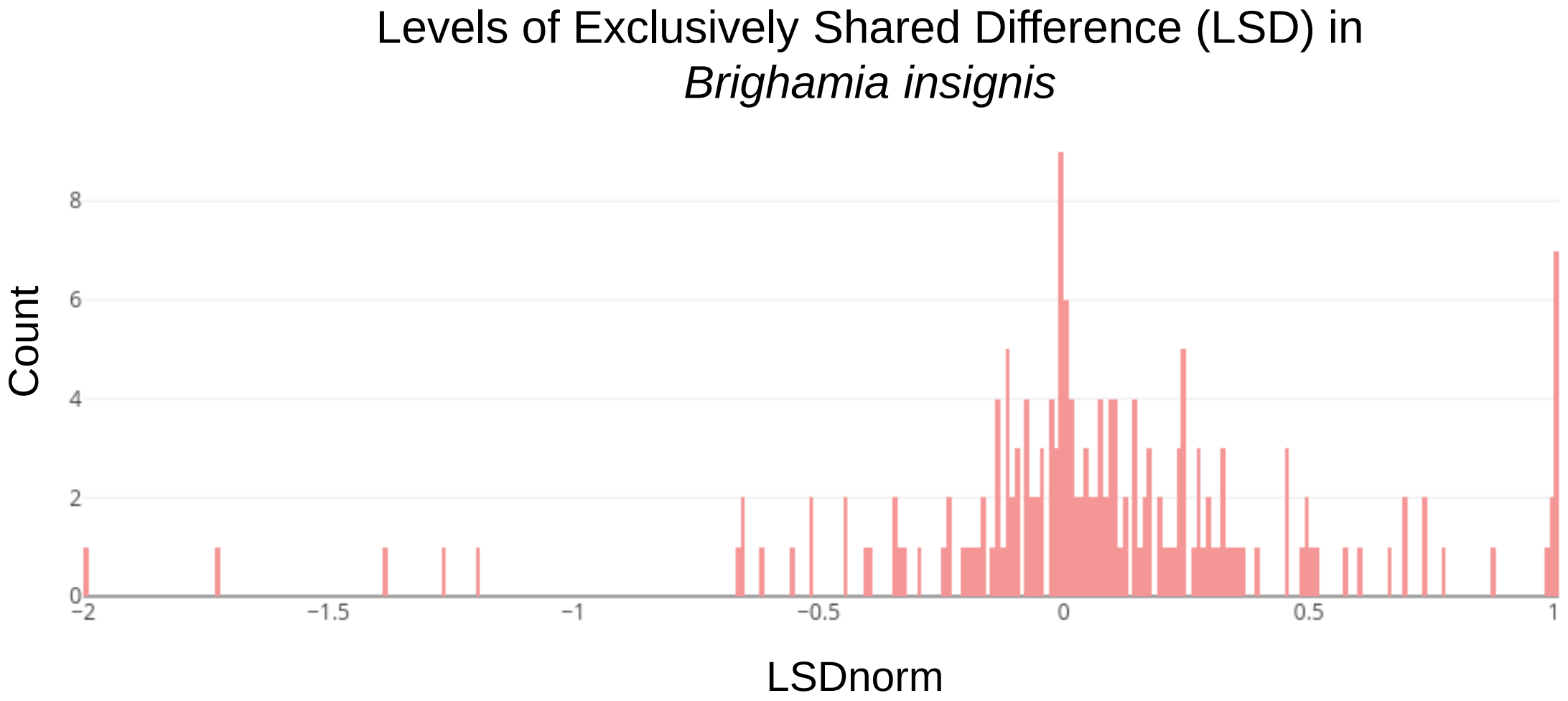

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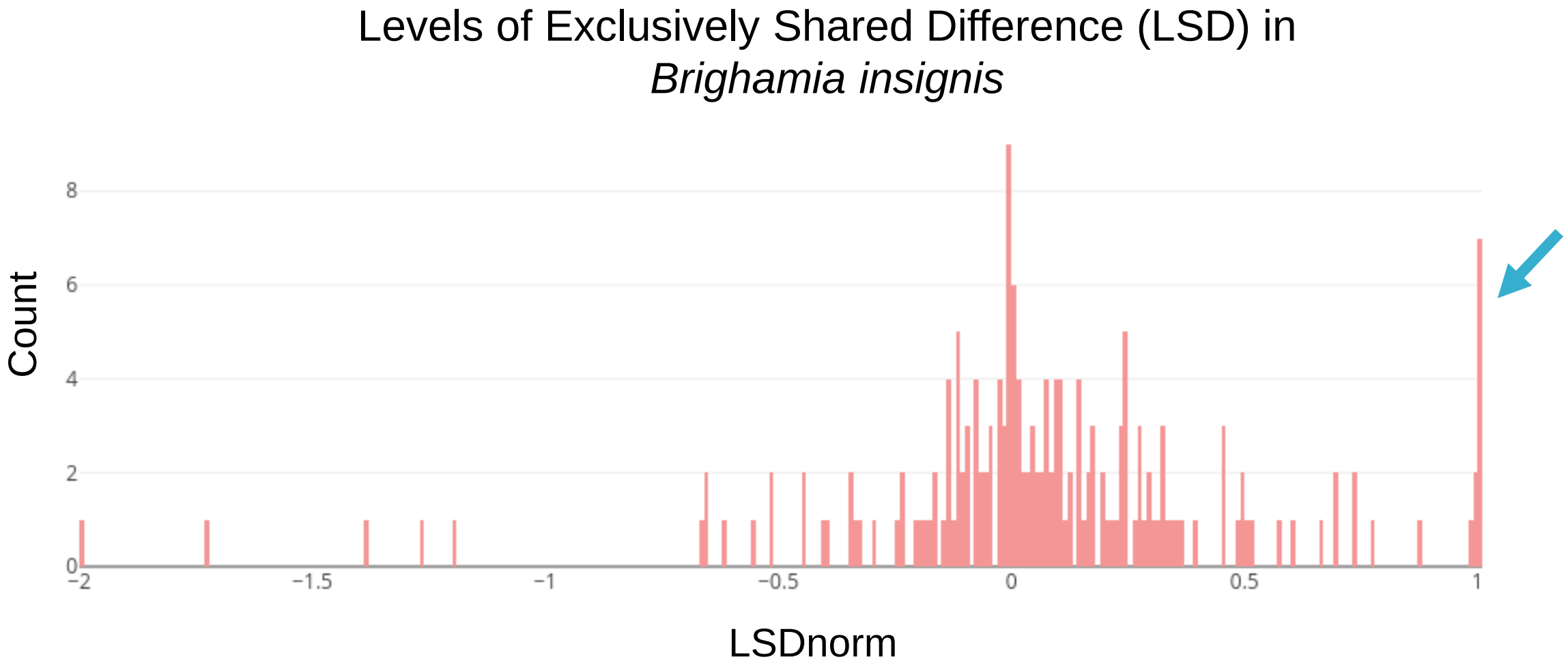

LSD can identify candidate genes under selection in discrete gene data sets

Brighamia insignis **collections**

The Chicago Botanic Garden in Glencoe, IL

←

The National Tropical Botanical Garden in Kalaheo, HI

→

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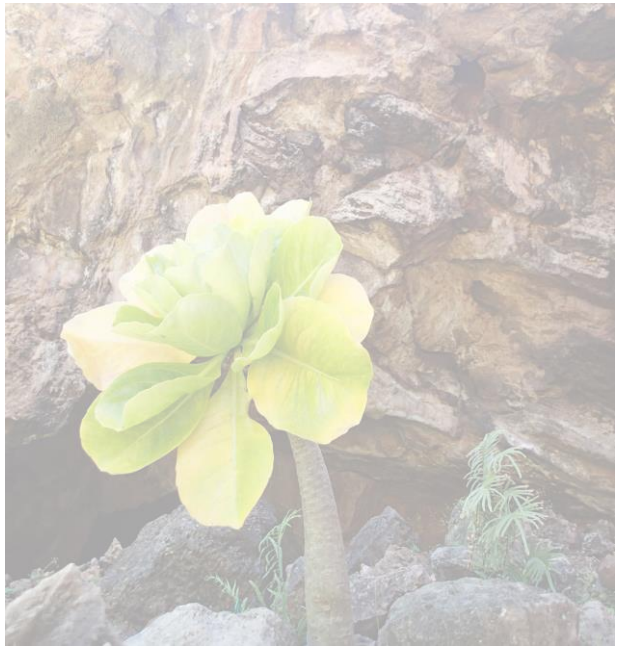


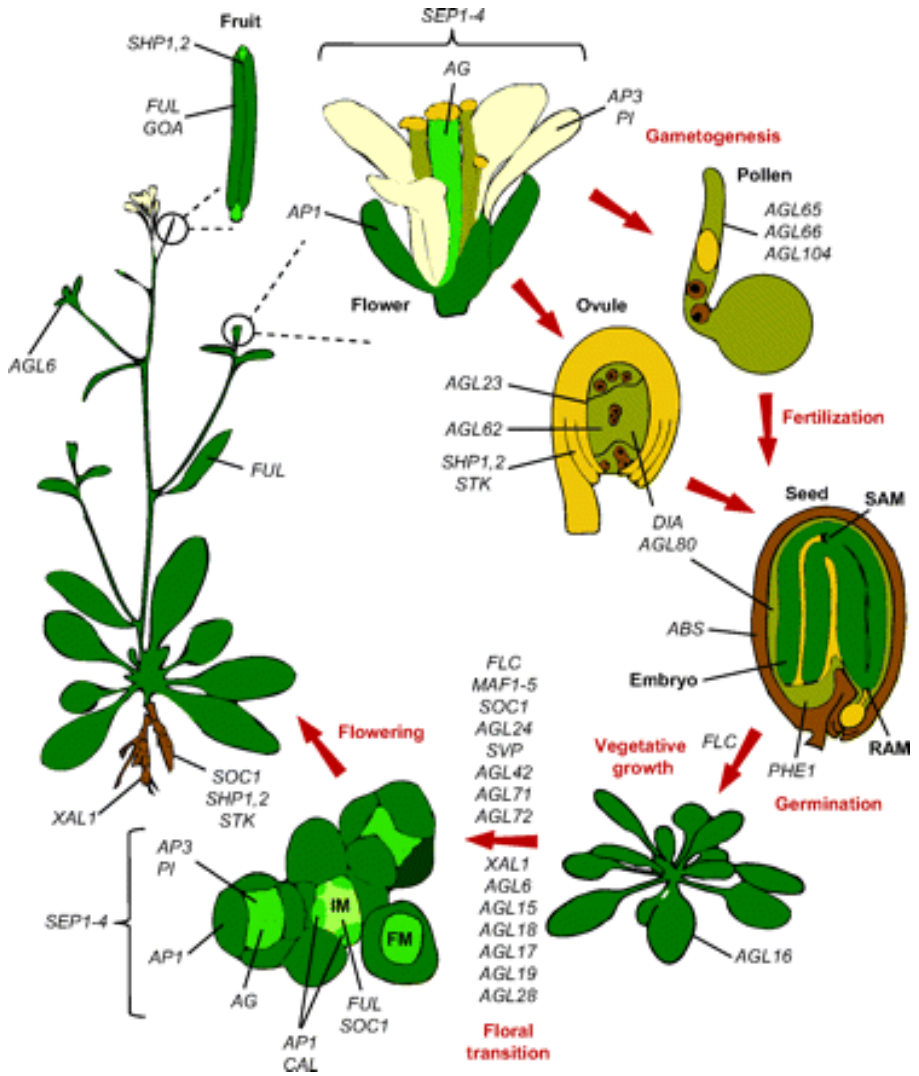
Improving Cultivars

Identifying genes underlying the traits of superior crop varieties

Artocarpus altilis
(Breadfruit)

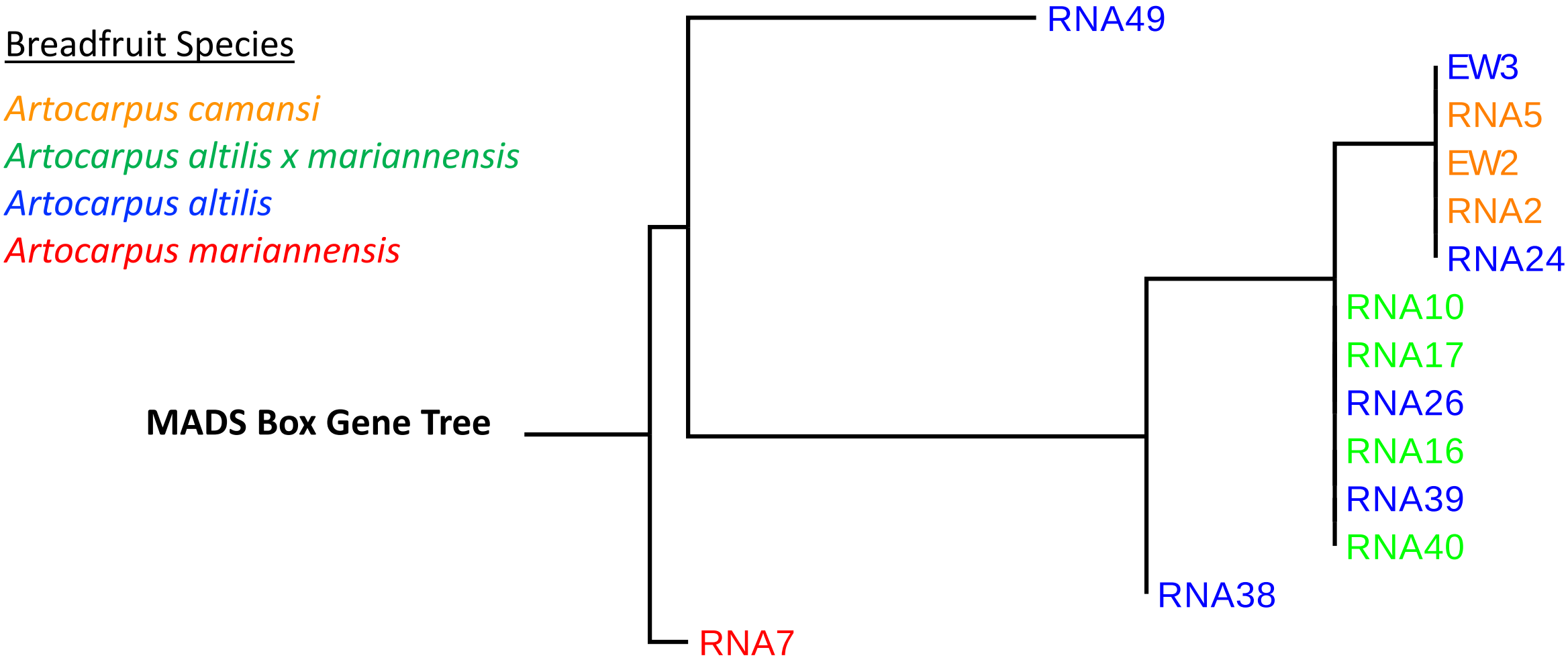
MADS Box genes regulate development processes in plants.

- Fruit development
- Flowering time
- Flower morphology
- Seed development



From Smaczniak et al. (2012)

LSD can identify candidate regions under selection in transcriptomic data sets



Adapted from Laricchia et al. (2018)

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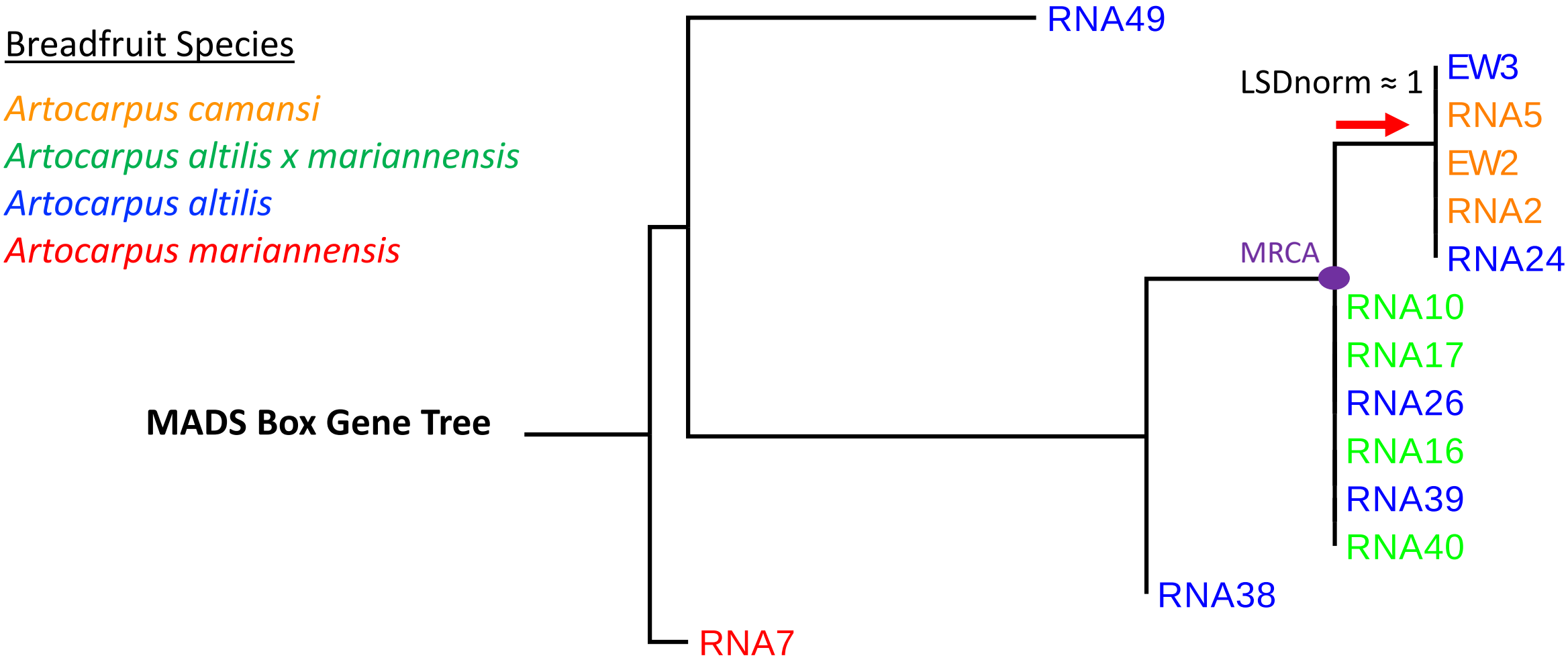

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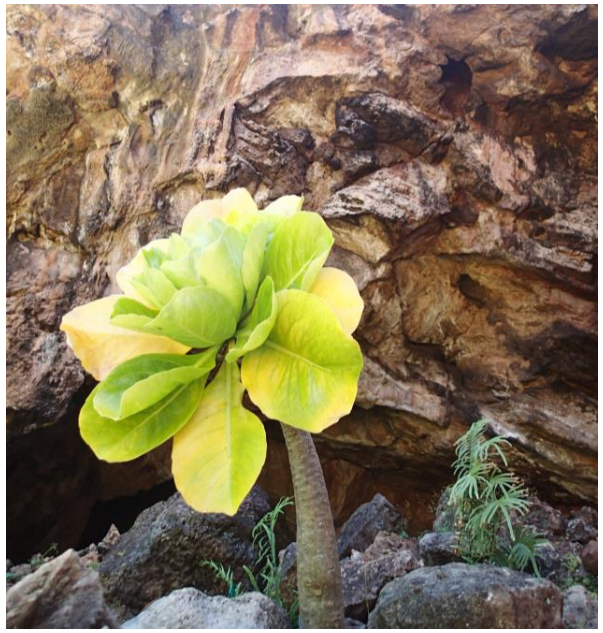
LSD helps plant biologists to study local adaptation.

Conservation



Improving Cultivars

The data we can use!

Thank you to everyone who made this presentation possible!

Colby Witherup
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Hilary Noble
Jordan Wood
Jeremie Fant
Norm Wickett

Northwestern University

CHICAGO BOTANIC GARDEN

REU Site: *Plant Biology & Conservation Research Experiences for Undergraduates from Genes to Ecosystems* (Supported by NSF award DBI-1757800)