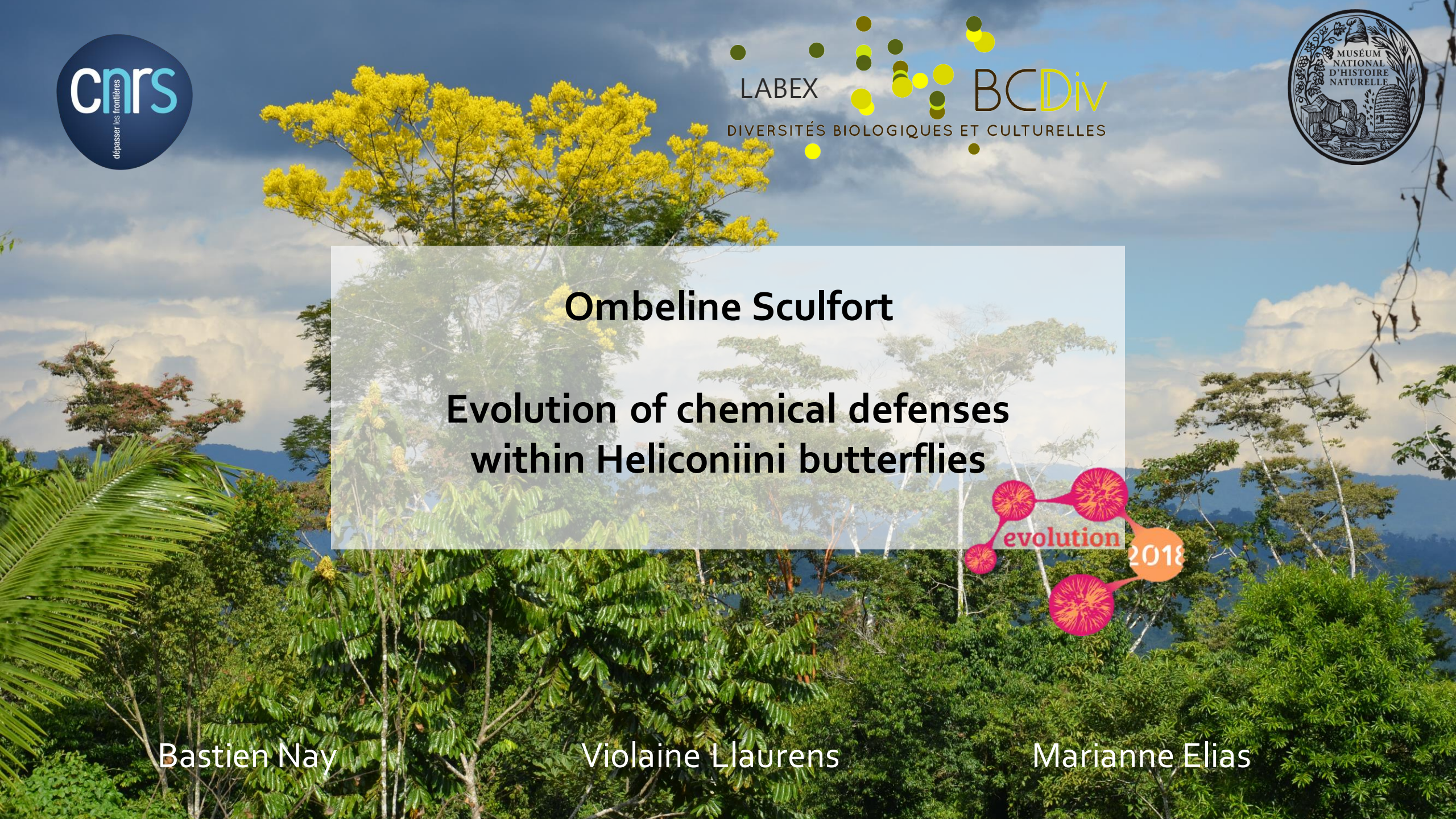


Ombeline Sculfort

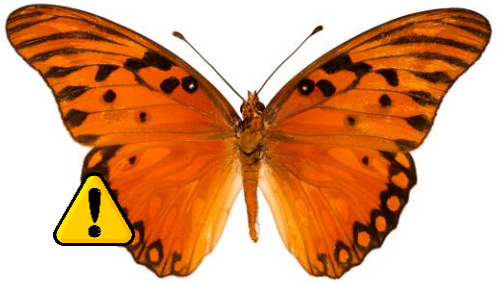
Evolution of chemical defenses within Heliconiini butterflies

Bastien Nay Violaine Llaurens Marianne Elias

INTRODUCTION – Heliconiini butterflies





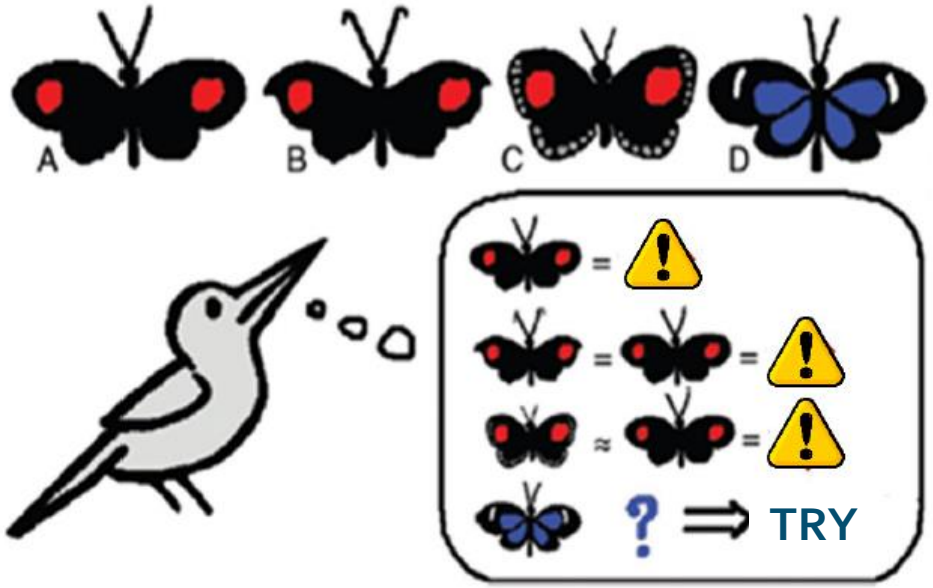




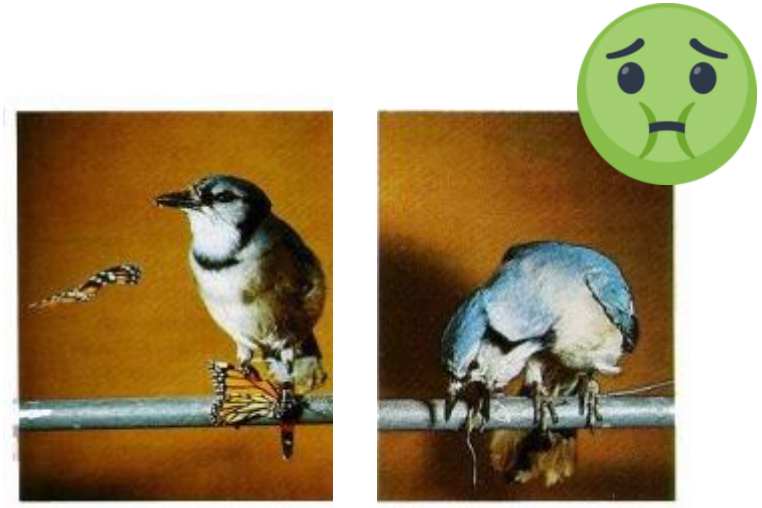
INTRODUCTION – Mullerian mimicry

Toxic species sharing common warning signal: wing pattern

- Convergent evolution
- Mimicry ring



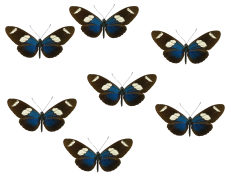
Modified from Mathieu Joron



bybio.wordpress.com

INTRODUCTION – Mimicry ring

Toxic species sharing a common warning signal within a **given habitat**

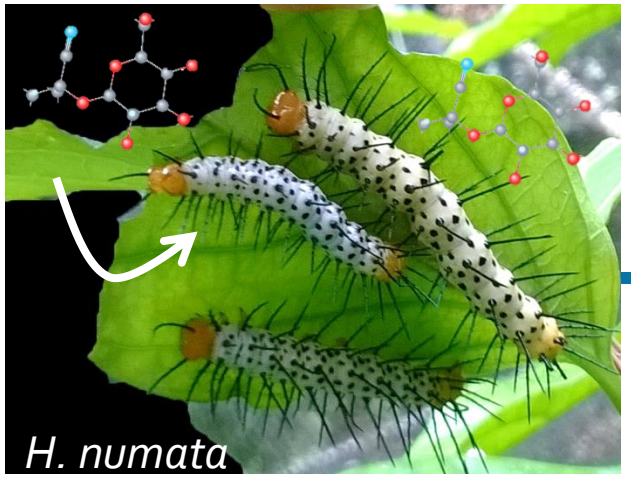


High abundance → low toxicity ?

Low abundance → High toxicity ?

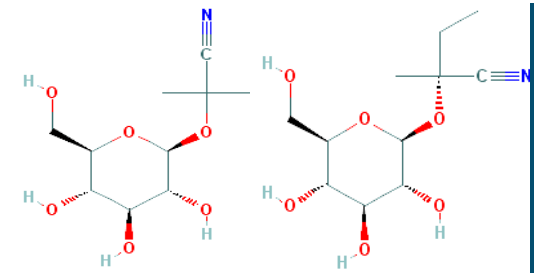
Butterfly toxicity modulates predator learning process

INTRODUCTION – What influence toxicity evolution?

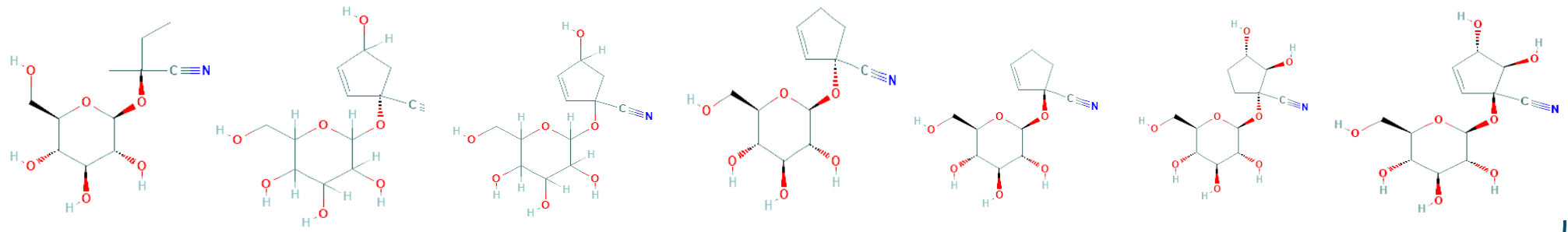


metamorphosis

- All stages are toxic: cyanogenic glucosides (CGs)
- Plant secondary metabolite (plant coevolution)
- Some are capable of *de novo* synthesis (larvae and adult)



Synthesized



Sequestered

QUESTIONS

Predation

PATTERN

TOXICITY

Plant coevolution

(new chemicals)

Mimicry ring

QUESTIONS

Predation

PATTERN

TOXICITY

Diversification?

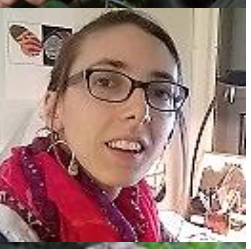
Plant coevolution

(new chemicals)

Mimicry ring

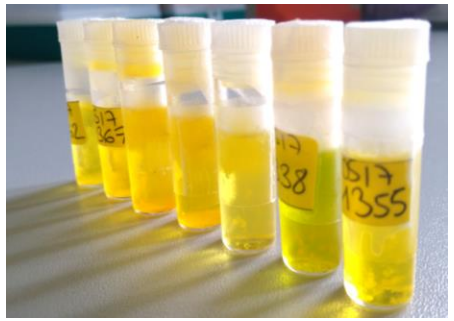
?

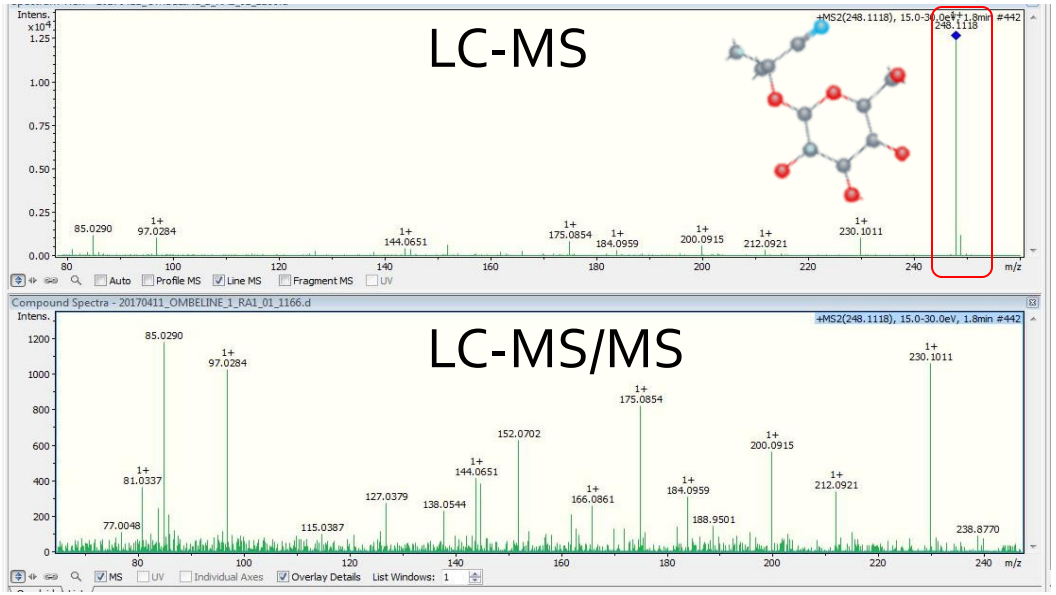
BUTTERFLY SAMPLING



155 wild butterflies
31 species, 7 genera
4 countries

Spatial data for ***Heliconius*** butterflies and allies
http://www.ucl.ac.uk/taxome/neil_rosser/

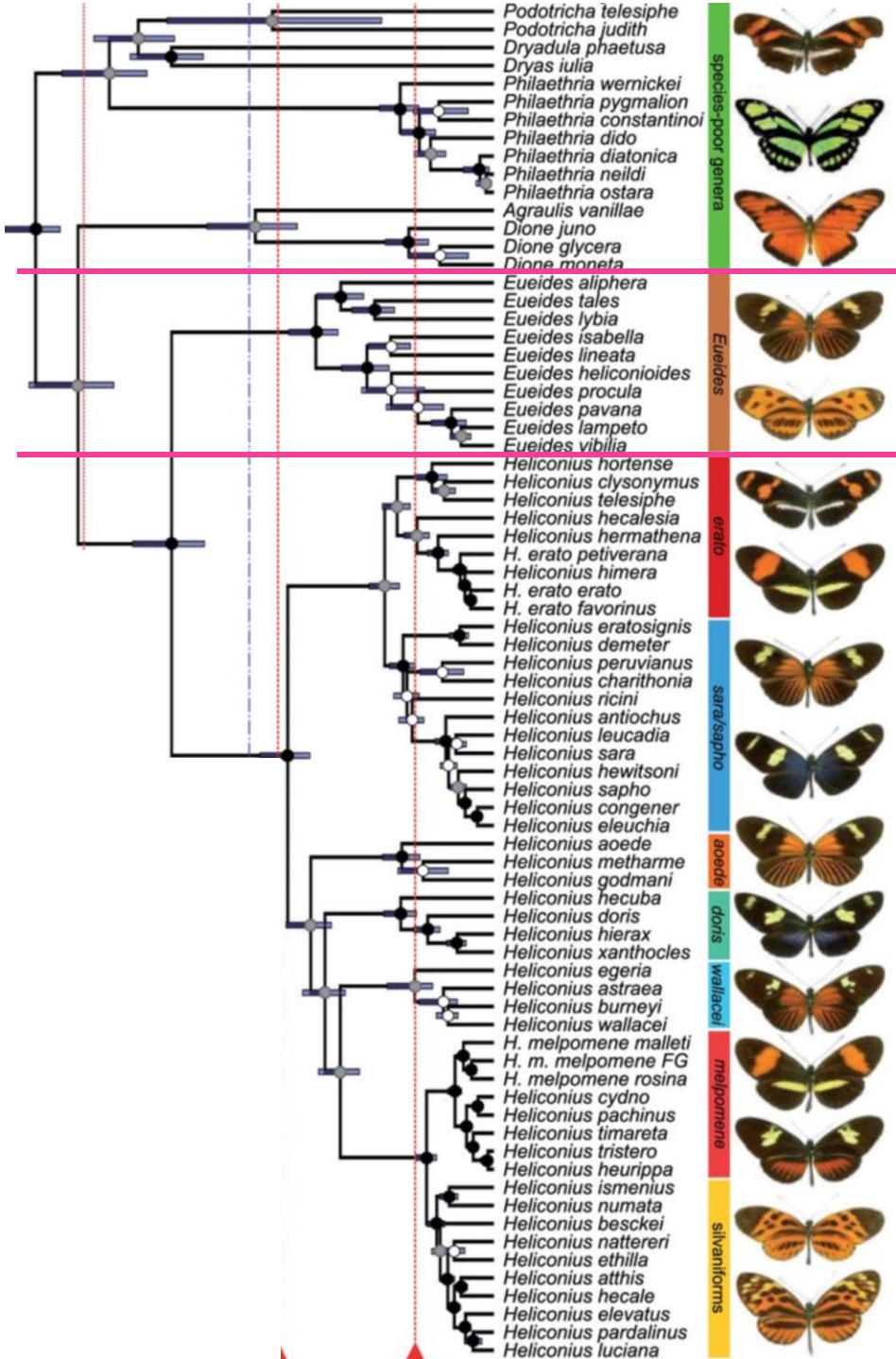




→ To identify and to quantify toxins

Heliconiini

77 species



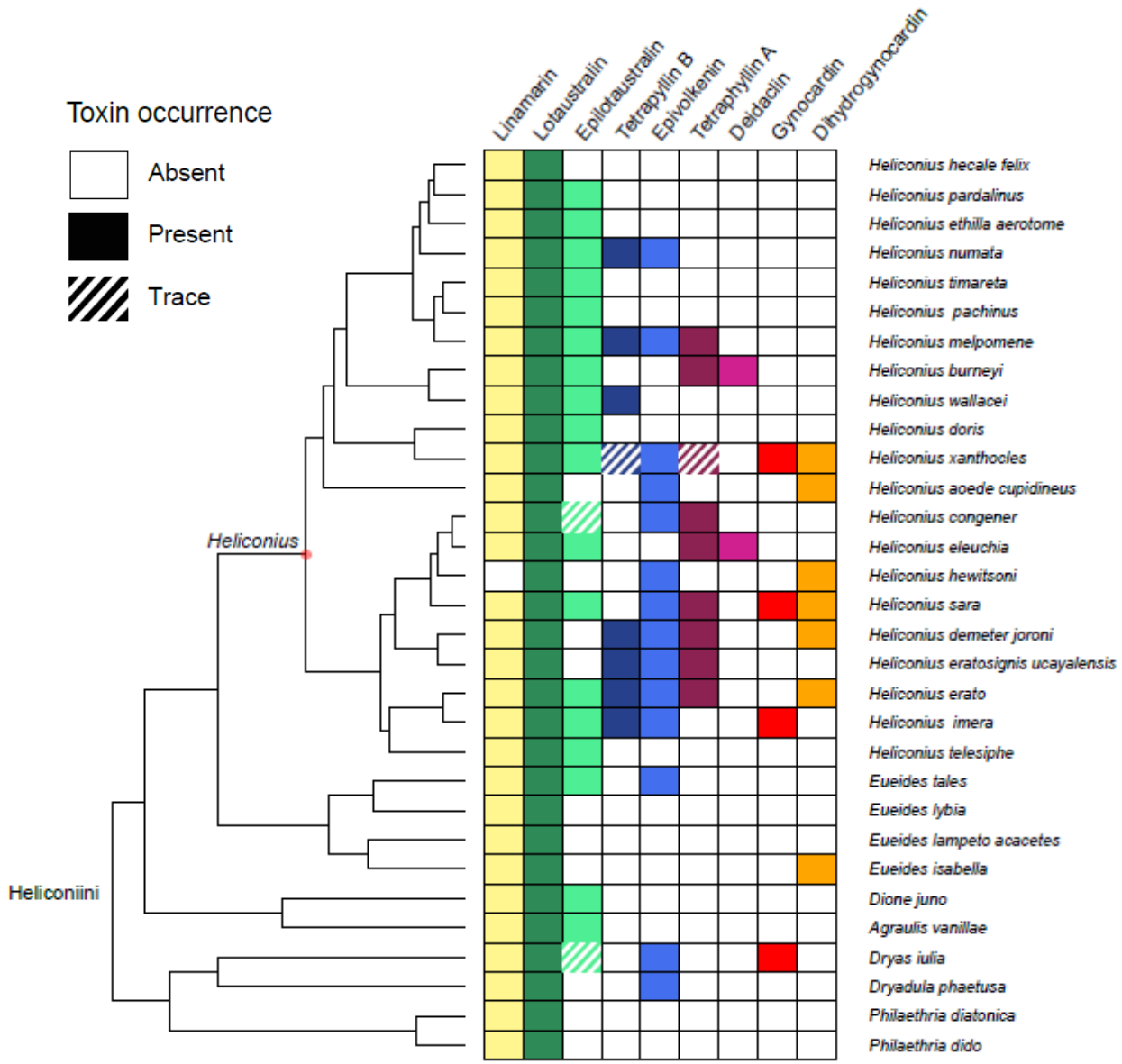
6 basal genera (6 species)

Eueides (4 species)

Heliconius (21 species)

Kozak *et al*,. 2015

1: Toxin diversification – qualitative variations



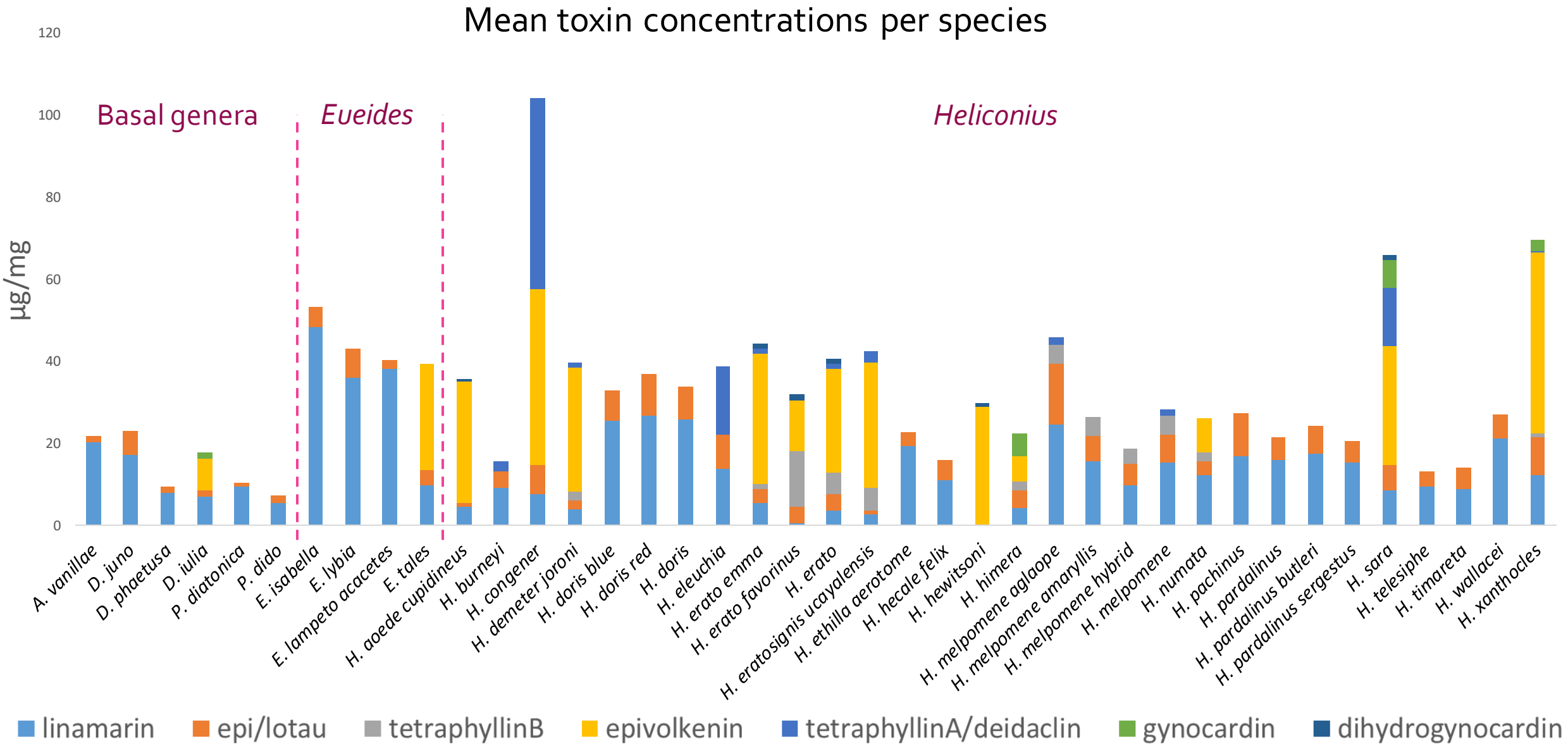
Phylogenetic signal: Blomberg's K

Synthesized toxins → significant
Appeared in common ancestor
(Zagrobelny *et al.*, 2018)

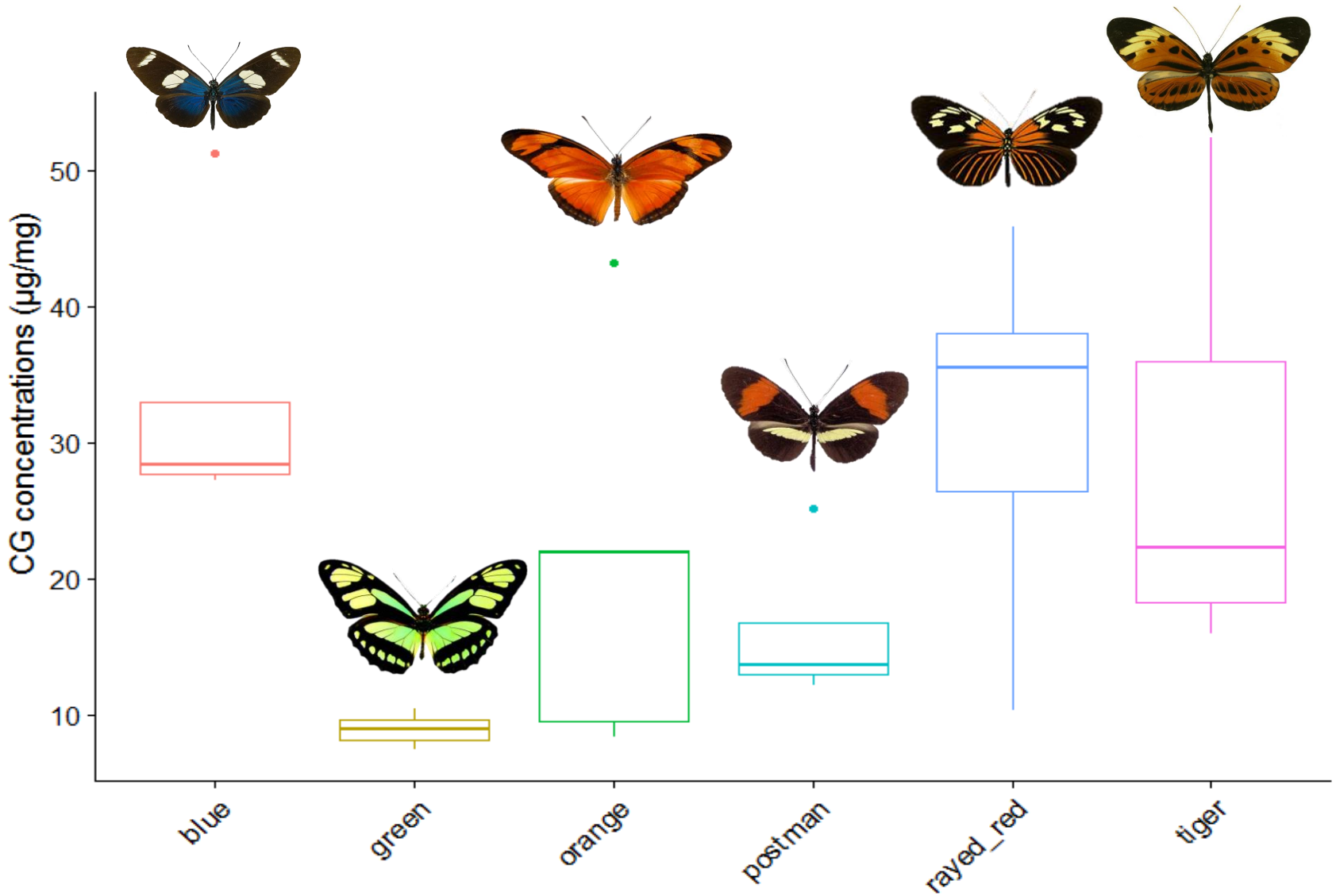
Sequestered toxins → NS
coevolution with hostplant?

Toxin diversification in *Heliconius*, linked to host plant shift?

1: Toxin diversification – quantitative variations



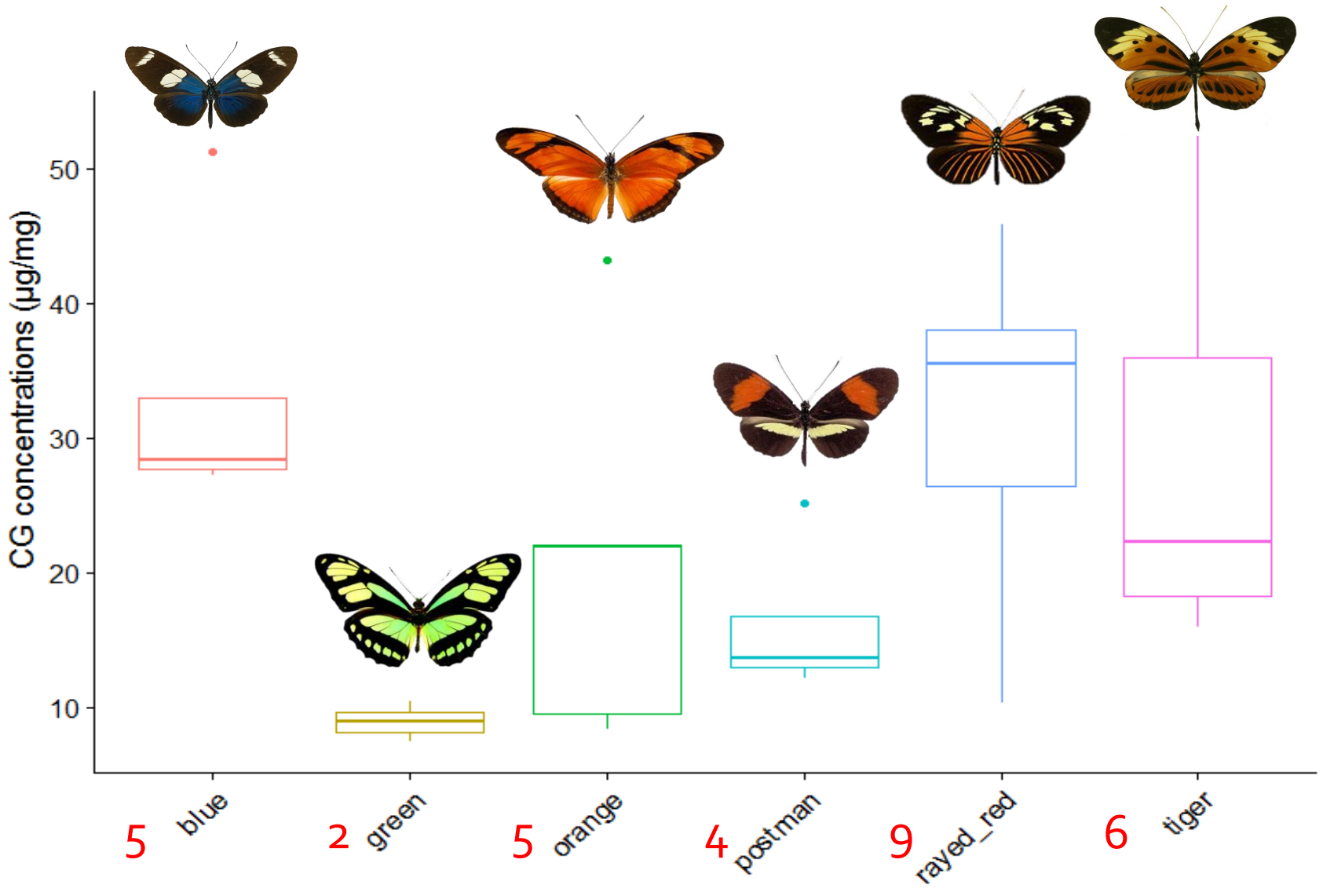
2: Variations among mimicry rings



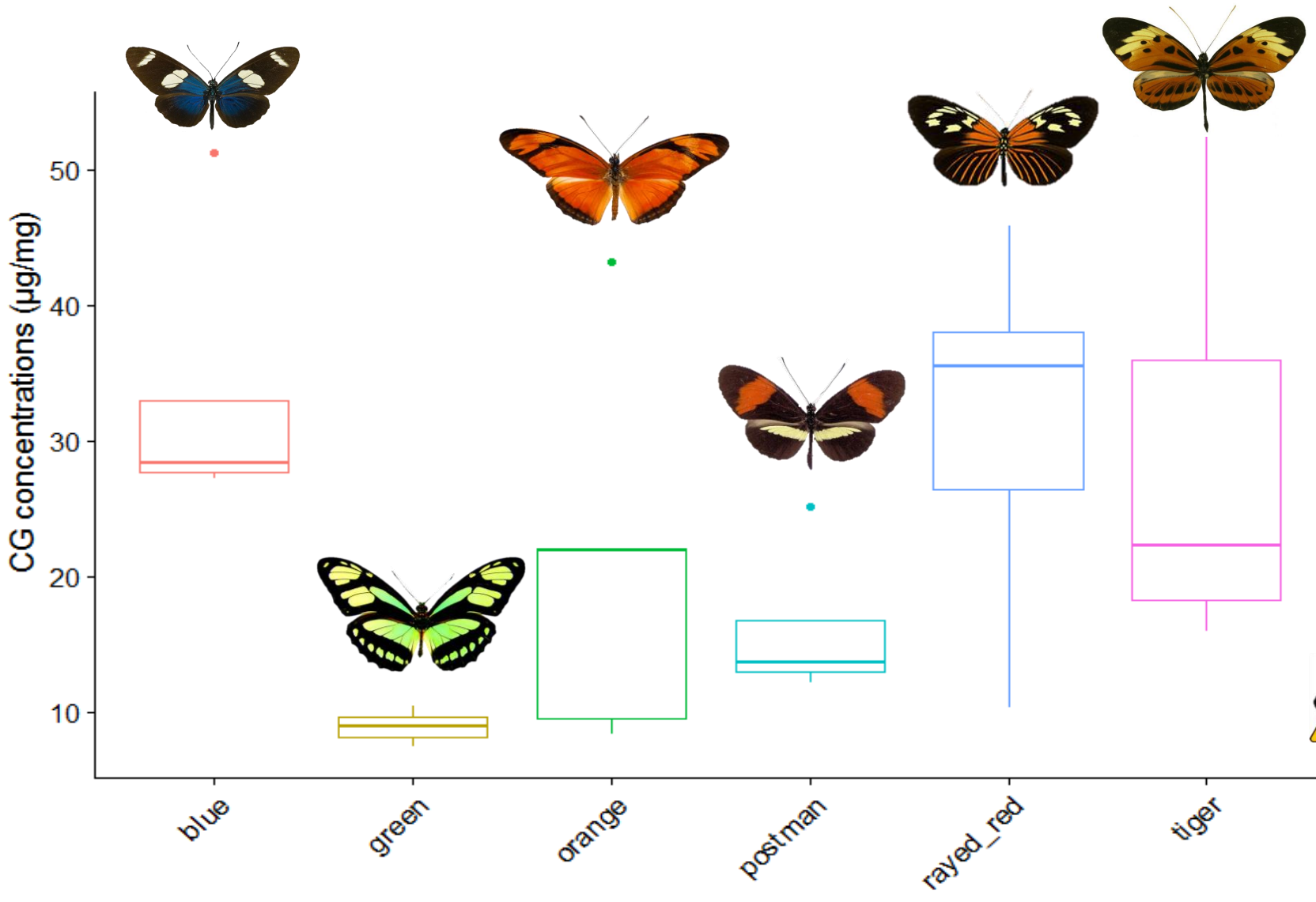
ANOVA
Pr(>F)
0.0719

Phylogenetic
ANOVA
Pr(>F)
0.525

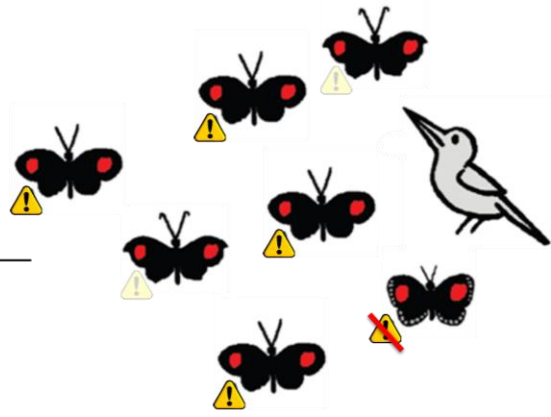
2: Variations among mimicry rings



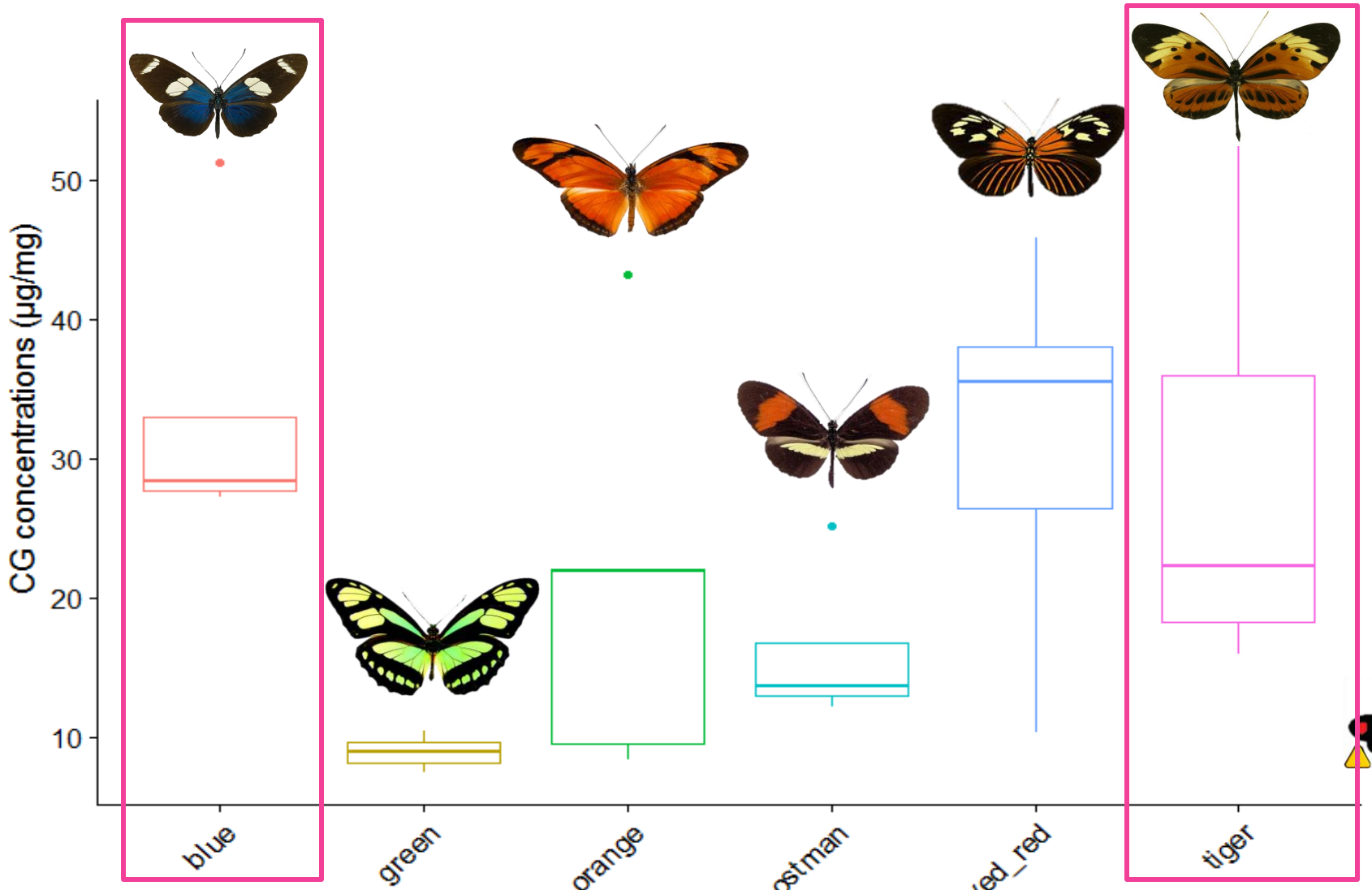
2: Variations among mimicry rings



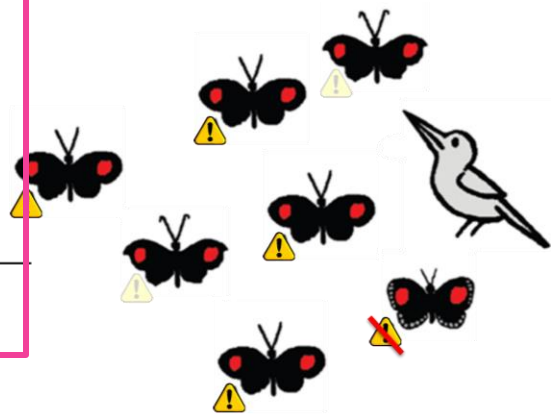
Within ring?



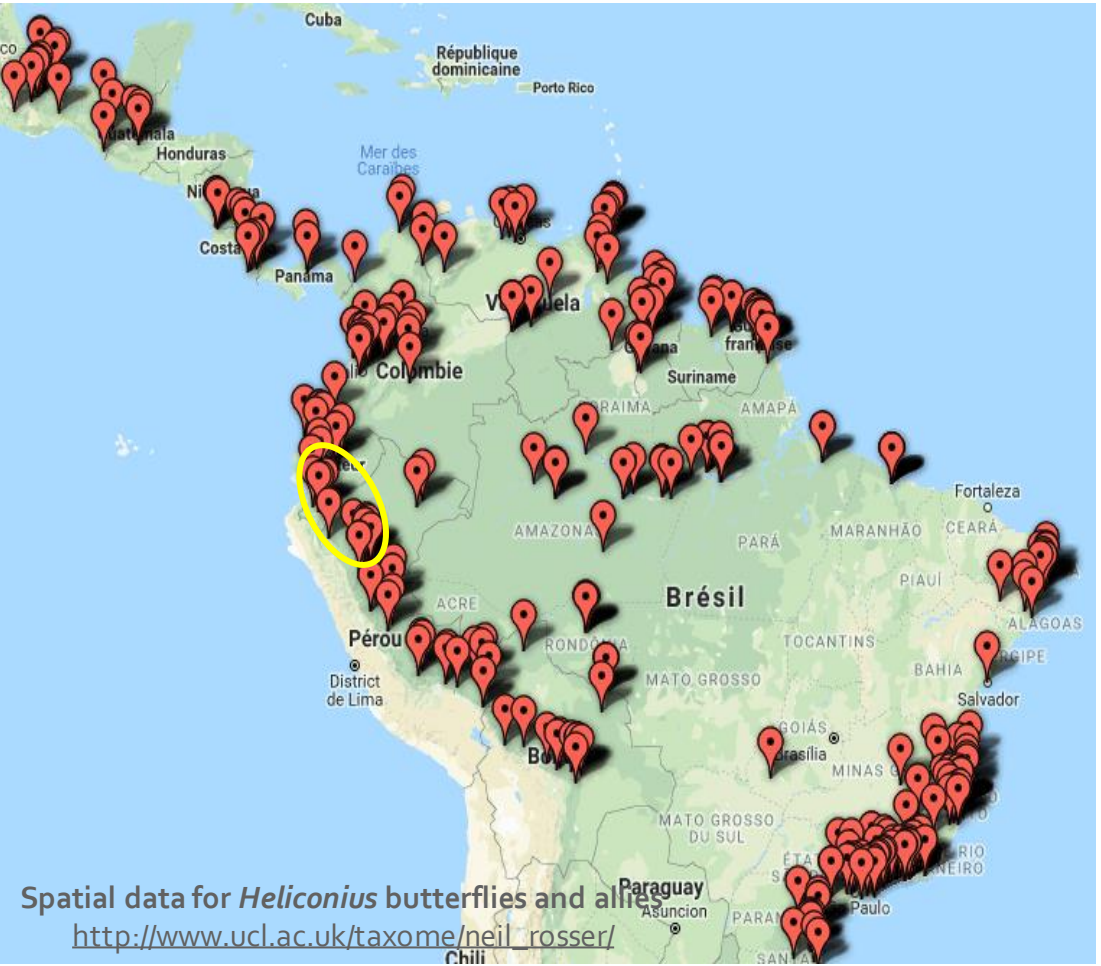
2: Variations among mimicry rings



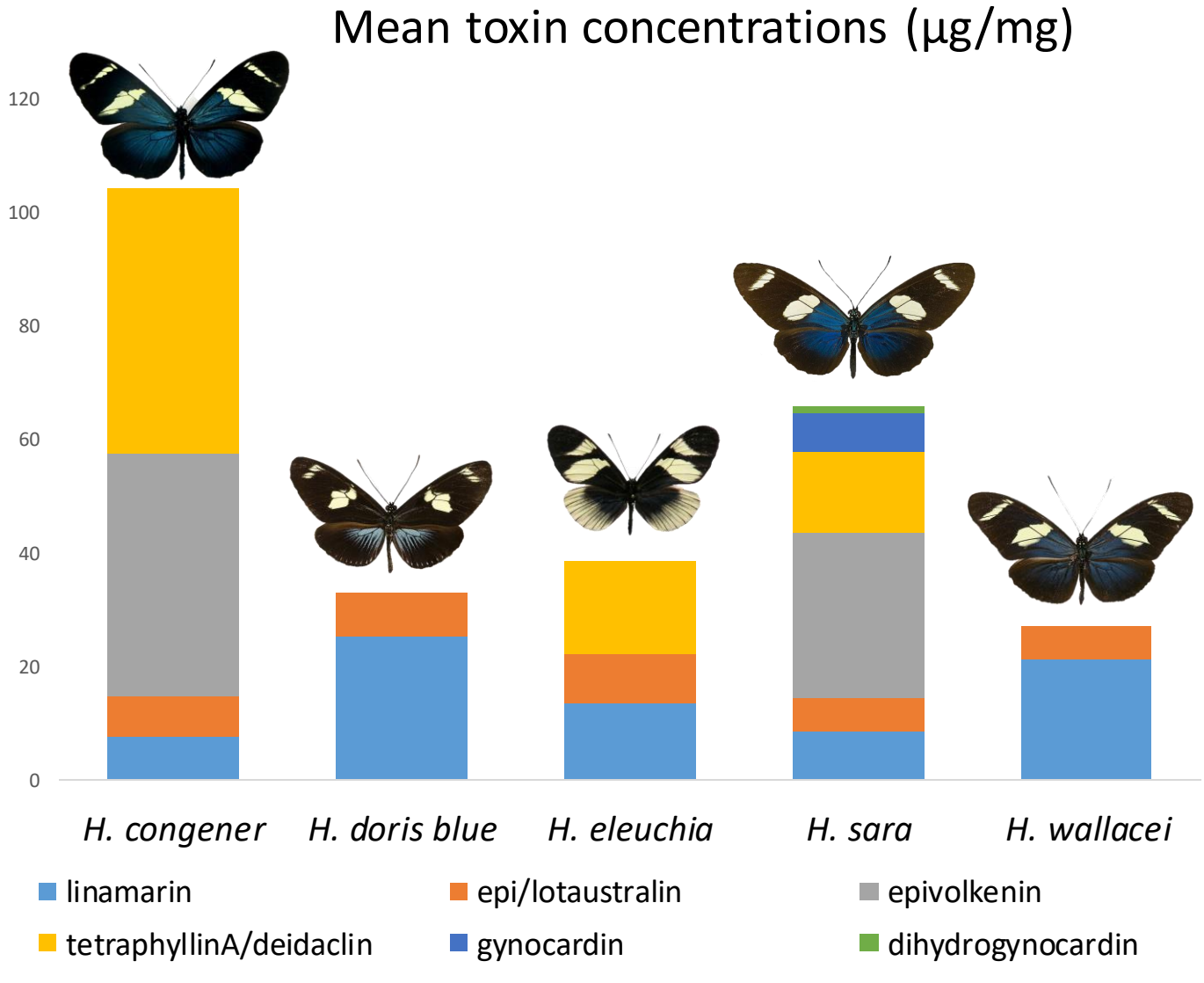
Within ring?



3: Variations within mimicry ring – Blue



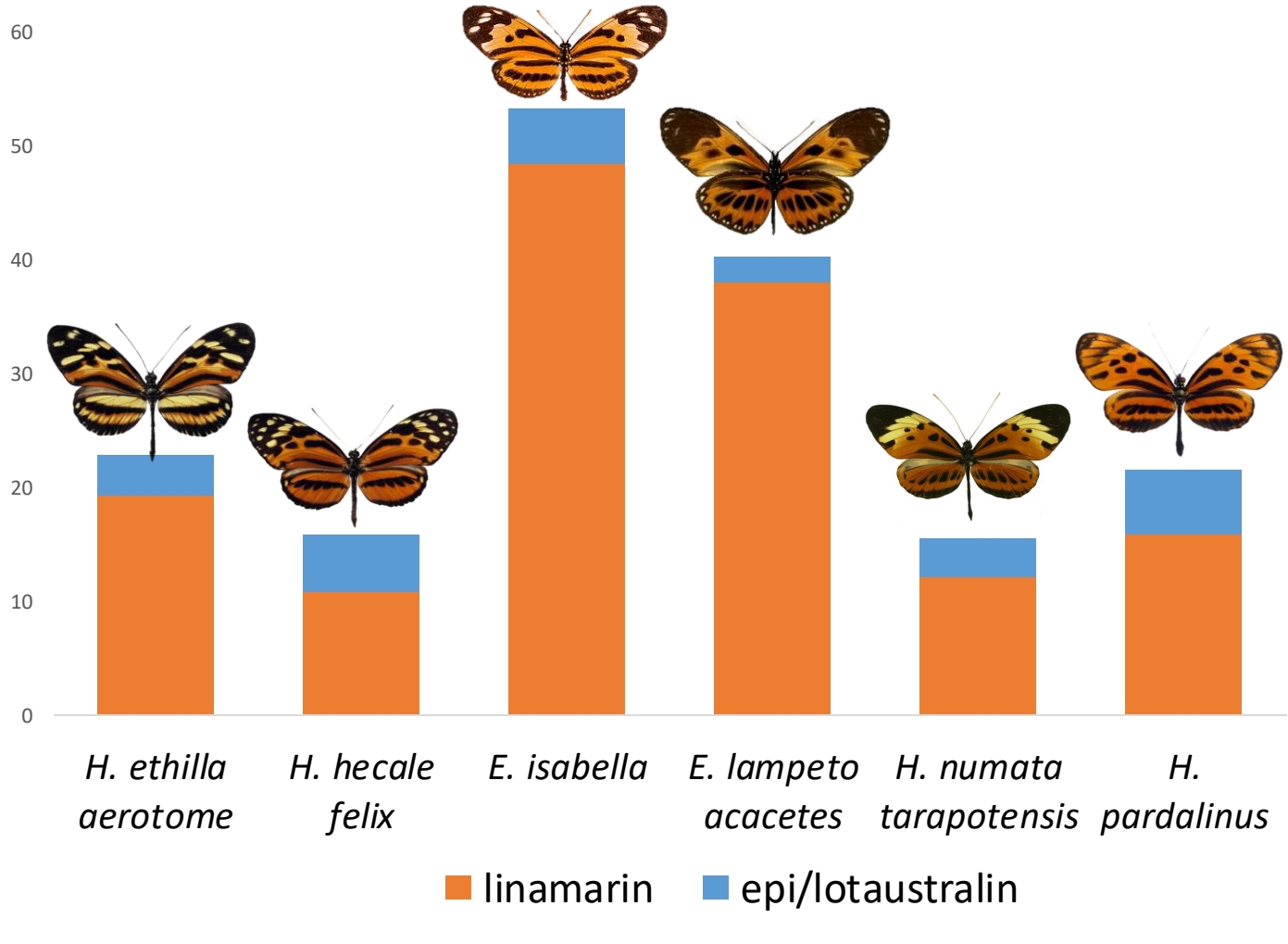
Spatial data for *Heliconius* butterflies and allies
http://www.ucl.ac.uk/taxome/neil_rosser/



3: Variations within mimicry ring – Tiger

Spatial data for *Heliconius* butterflies and allies
http://www.ucl.ac.uk/taxome/neil_rosser/

Mean toxin concentrations (µg/mg)



CONCLUSION



Toxin diversification

- Diversification of toxin composition in *Heliconius*, linked with host plant?
- No variations in toxin concentrations

Among mimicry ring

- No strong effect of mimicry among groups

Within mimicry ring

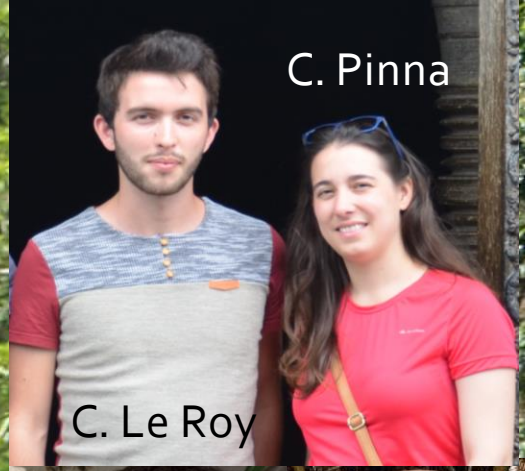
- Evolution of toxicity leads to different way of acquiring toxins
- No significative results

Toxicity evolution → Phylogeny = synthesized toxins + ecology = sequestered toxins

Increase sample size!

THANK YOU !

ESEB Organizers



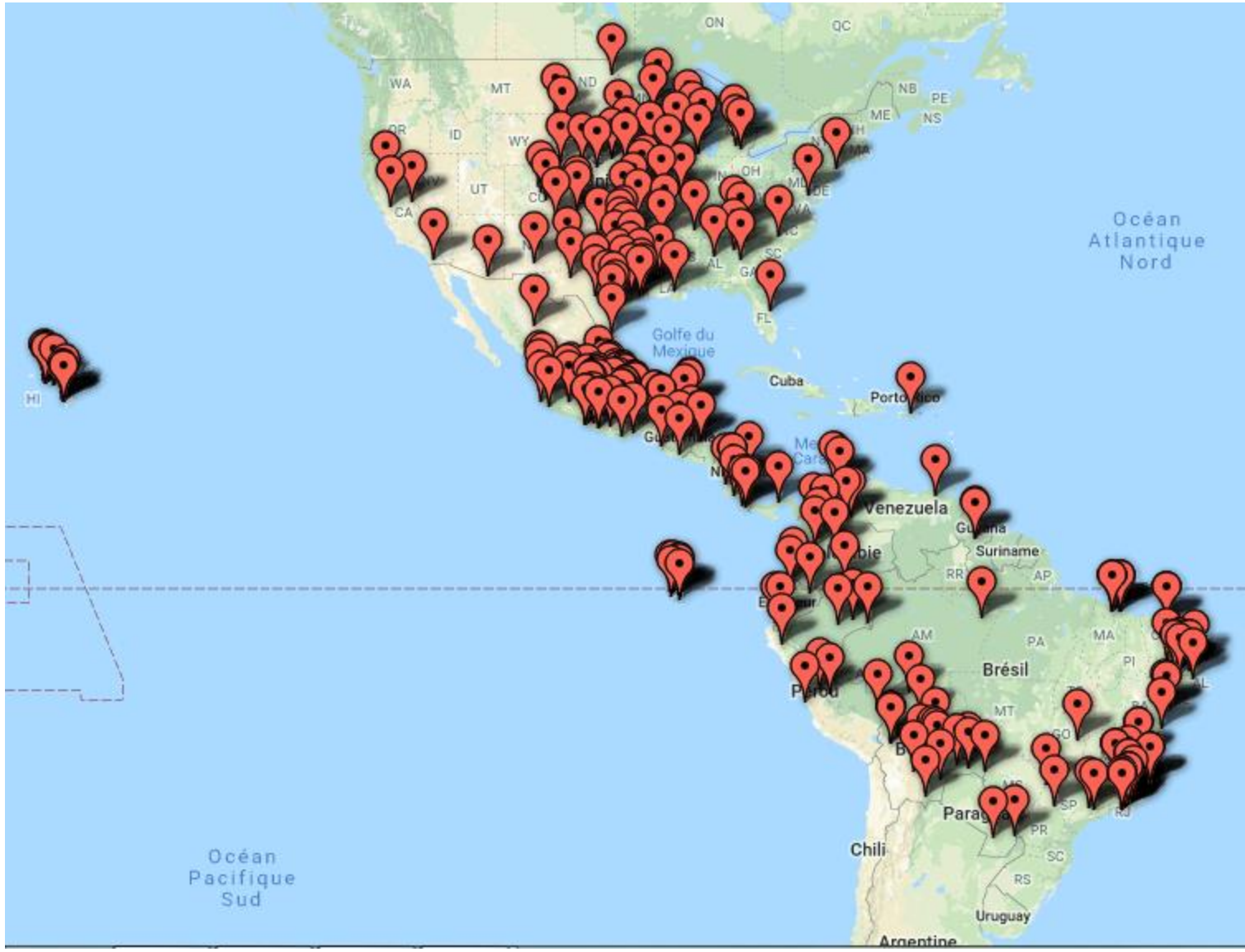
LABEX BCDiv
DIVERSITÉS BIOLOGIQUES ET CULTURELLES

EMILIE SHELL RODD PLANTE/BUTTERFLIES

All the tiger butterflies, belonging to my rayed red ring

Emilie shell rodd plante/butterflies

All the tiger butterflies, belonging to my orange ring



All the tiger butterflies, belonging to my postman ring