



# Why are there so many butterflies?

Tropical environments have a huge variety of butterflies, each with its own peculiarities and adaptations. Mimetic butterflies are an excellent system for investigating how all these species co-exist. Mimicry, where two or more distantly related species resemble each other, often evolves when these species are toxic to predators, and have bright warning colors. Species that look the same are said to belong to a 'mimicry ring'. By looking the same, predators such as birds encounter

the warning signal more often, and quickly learn not to eat those butterflies. The more butterflies with that warning signal, the faster the predators learn. But tropical habitats often support many, diverse mimicky rings. So why don't they all converge on the same color pattern? The answer lies in the ecological conditions that drive species diversification.

Two mimetic butterflies: *Phalaethria dido* and *Siproeta stelenes*.



## Tropical forests are not homogenous.

A small area of forest can include many pockets of habitat with different features: the open canopy, dark understory, damp streams or more sunny clearings. These are referred to as 'micro-habitats'.

## Micro-habitat specialization can help explain why there are so many species.

It also emphasizes the need to protect the forest as a whole, to support the conservation of diverse and healthy ecosystems.



## Different micro-habitats, different conditions

The way in which the canopy blocks, transmits or reflects light together with landscape features like streams and rivers, create micro-habitats with distinct sensory conditions.

## Different micro-habitats, different plants

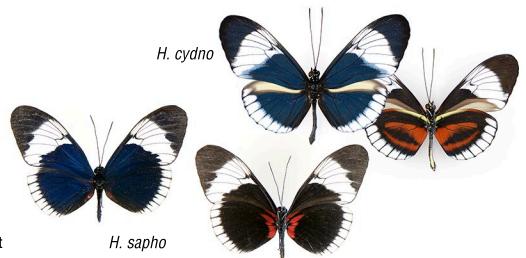
This can help segregate butterfly species if they are restricted to conditions where their host plants are found.

## Different micro-habitats, different warning signals

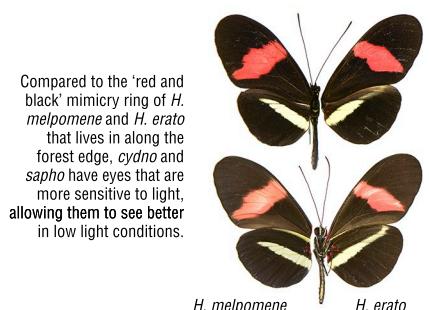
Some signals may be more effective in different communities of birds, either due to the sensory bias of the birds, or the sensory conditions of the forest. As a result, different micro-habitats can support different mimicry rings.

## Different traits, different uses

*Heliconius* butterflies use their colour patterns as mating cues. Shifts in mimicry ring can therefore lead to reproductive isolation between populations, helping promote speciation.



*Heliconius cydno* and *Heliconius sapho* belong to a 'black and white' mimicry ring in the inner forest in Panama. In this environment, where the canopy is closed, light is less abundant in the understory.



Compared to the 'red and black' mimicry ring of *H. melpomene* and *H. erato* that lives in along the forest edge, *cydno* and *sapho* have eyes that are more sensitive to light, allowing them to see better in low light conditions.