HONDURAS DISSERTATION/THESIS PROJECT

HO15 Evolution of aposematic coloration and mimicry in coral snakes

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Brightly coloured and deadly coral snakes and their harmless mimics are some of the most striking denizens of Cusuco National Park. The primary driver of this type of bright coloration is convergent evolution, where natural selection impels distantly-related organisms towards a shared phenotype. Biologists have long been fascinated by how selection can cause organisms to converge on a single phenotype despite different developmental and genetic backgrounds and being separated by millions of years of evolution. Mimicry is one of the most dramatic examples of convergent evolution and in particular, coral snake mimicry is a powerful example of Batesian mimicry, which occurs when a harmless species resembles a harmful species for a protective purpose. Coral snakes are dangerous venomous elapid snakes that are usually brightly coloured and banded. Across the geographical range of coral snakes, and sometimes outside of their geographical range, harmless snakes mimic coral snakes with the same coloured crossbands. For this project, we will study the ecological and evolutionary dynamics of coral snake mimicry in Cusuco National Park, which is home to at least two coral snake species and nine coral snake mimicking species. Dissertation students will participate in all aspects of this project (except that venomous snakes will only be handled by a trained herpetologist), which will include 1) using spectrophotometry or full-spectrum photography to quantify colour of coral snakes, mimics, and non-mimicking snakes, 2) characterising the ecological and habitat distributions of coral snakes and mimics, and 3) using plasticine models to test for predation rates on different coral snake and coral snake mimic banding patterns.

The third element (building plasticine models and testing for predation rates) will form the most extensive part of this project. Students will use different colored blocks of clay (red, white, black, and brown) to sculpt a series of models that range from being exact mimics of coral snake colors through to models with minor variations in coloration (like some mimics possess) and to colors which are completely different from those usually possessed by coral snakes. Students will set these models out in clusters at various survey sites in the Park, and will check them for bite marks and other attack marks (easily visible in the soft clay of the models) daily. Students will gather data on how often each type of model is attacked, which parts of the different models are most frequently attacked (head, middle, tail), and frequency of attacks by birds and mammals (where this is determinable). This will allow students to gather data on whether close coral snake mimics are attacked at different rates to non-mimicking snakes or poorly-mimicking snakes, and also whether attacks are predatory or defensive in nature.

Recommended Reading

Brodie ED. (1993) Differential avoidance of coral snake banded patterns by free-ranging avian predators in Costa Rica. *Evolution* **47**: 227–235.

Johnstone RA. (2002) The evolution of inaccurate mimics. *Nature* **418**, 524–526.

Mallet J. & Joron M. (1999) Evolution of diversity in warning color and mimicry: polymorphisms, shifting balance, and speciation. *Annu. Rev. Ecol. Syst*. 30: 201–233.

Penney HD, Hassall C, Skevington JH, Abbott KR. & Sherratt TN. (2012) A comparative analysis of the evolution of imperfect mimicry. *Nature* **483**: 461–464.

Pfennig DW, Harcombe WR. & Pfennig KS. (2001) Frequency-dependent Batesian mimicry—Predators avoid look-alikes of venomous snakes only when the real thing is around. *Nature* **410**: 323–323.

Smith SM. (1975) Innate recognition of coral snake pattern by a possible avian predator. *Science* **187**: 759–760.