Drivers of larval gregariousness in Lepidoptera

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Project description:
Gregarious behaviour has evolved many times in a wide range of animals. The prevalence of gregariousness poses many interesting evolutionary questions; For example, how is the conflict between competition and cooperation balanced? What are the advantages of social behaviour? And what are the costs? But it also leads to many mechanistic questions; how do animals sense each other? How do they track each other's behaviour?

This project aims to tackle these questions using Heliconiini, a diverse tribe of Neotropical butterflies, as a study system. Gregarious larval behaviour has evolved in multiple independent lineages, and in some cases closely related species differ dramatically in egg laying and larval behaviour. The primary goals of the project are to:

i) Develop protocols to accurately quantify gregarious behaviour across species and larval stages.

ii) Conduct comparative analyses to explore the interactions between gregarious behaviour, colouration, predator avoidance, and host plant morphology.

iii) Perform experiments to establish what sensory cues gregarious species use to maintain group cohesion.

iv) Use available comparative genomics and new neurotranscriptomic data to identify candidate genes that may contribute to larval behaviour.

The project will suit a highly motivated student interested in integrating different approaches to understanding behavioural variation. In addition to core DTP training they will receive guidance in experimental design, comparative methods, image processing and genomics. The project will involve periods of fieldwork in the Smithsonian Tropical Research Institute's insectaries in Gamboa, Panama, which is the center of a large international community working on Heliconius butterflies.

Background reading

Montgomery SH, Merrill RM, Ott SR. Brain composition in Heliconius butterflies, posteclosion growth and experience-dependent neuropil plasticity. Journal of Comparative Neurology. 2016 Jun 15;524(9):1747-69.

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Ioannou CC, Guttal V, Couzin ID. Predatory fish select for coordinated collective motion in virtual prey. Science. 2012 Sep 7;337(6099):1212-5.

Beltrán, M., Jiggins, C. D., Brower, A. V., Bermingham, E., & Mallet, J. (2007). Do pollen feeding, pupal-mating and larval gregariousness have a single origin in Heliconius butterflies? Inferences from multilocus DNA sequence data. Biol. J. Linnean Soc., 92(2), 221-239.