



## HONDURAS DISSERTATION/THESIS PROJECT

### HO10 Community ecology of insect herbivores associated with coffee and its wild relatives

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Insects on plants make up the majority of terrestrial macro-diversity and underpin tropical ecosystems. While some insects provide vital pollination services, others are antagonistic herbivores. In response to herbivory, plants have developed a bewildering array of chemical defences, and insects must contend with a complex landscape of toxic plant compounds

(e.g. polyphenols, alkaloids and terpenes). This in turn has led to the evolution of specialisation of insect herbivores onto groups of closely related and chemically similar plants. The alkaloids contained in the coffee family (Rubiaceae) are consumed by humans for their stimulant and hallucinogenic effects. Developing an understanding of the insect herbivores which interact with coffee and its wild relatives, either antagonistically or otherwise, therefore has important economic implications, as well as providing an avenue for novel academic research.

The cloud forests of Cusuco National Park, north-west Honduras, are a centre of diversity for Rubiaceae plants, with more than a dozen potential study genera occurring. One of most common genera in Cusuco, however, is also the largest genera in the Family; *Psychotria*, which, with >2,000 species occurring worldwide, has become a model for studying the evolution of plant defences and insect diversity.

This project gives students an opportunity to conduct a novel study into the herbivorous insect community of Rubiaceae plants in Cusuco, with a strong recommendation towards focussing on the 15 local species of *Psychotria* found in the Park. Different species of *Psychotria* can be identified within different altitudinal bands of the park, and the insect community associated with these different *Psychotria* determined by placing shallow trays beneath each plant and carefully beating the leaves so insects fall into these trays, as well as directly collecting any insects which are conspicuously visible.

At the end of their projects, students will have collected a dataset which can be analysed to provide an overview of the diversity and structure of insect species associated with *Psychotria* in Cusuco National Park, as well as address certain ecological questions, such as how this diversity and structure varies along elevational or altitudinal gradients.

While a project focussing on *Psychotria* is particularly recommended given the abundance and diversity of this group in Cusuco, there are also possibilities to run projects focussing on other large genera such as *Miconia* and *Piper*, subject to discussing this with the project supervisors during the run-up to the initial project proposal submission.

### Recommended Reading

Novotny, V. & Basset, Y. (2005) Host specificity of insect herbivores in tropical forests. *Proceedings of the Royal Society B: Biological Sciences* 272: 1083-109

- Novotny, V., Drozd, P., Miller, S.E., Kulfan, M., Janda, M., Basset, Y. & Weiblen, G.D. (2006) Why are there so many species of herbivorous insects in tropical rainforests? *Science*, 5790: 1115-1118.
- Novotny, V., Miller, S.E., Hulcr, J., Drew, R.A.I., Basset, Y., Janda, M., Setliff, G.P., Darrow, K., Stewart, A.J.A., Auga, J., Isua, B., Molem, K., Manumbor, M., Tamtiai, E., Mogia, M. & Weiblen, G.D. (2007) Low beta diversity of herbivorous insects in tropical forests. *Nature*, 448: 692–695.
- Solé, R., Gripenberg, S., Lewis, O.T., Markesteijn, L., Barrios, H., Ratz, T., Ctvrticka, R., Butterill, P.T., Segar, S.T., Metz, M.A., Dahl, C., Rivera, M., Viquez, K., Ferguson, W., Guevara, M. Basset, Y. (2019) The role of herbivorous insects and pathogens in the regeneration dynamics of *Guazuma ulmifolia* in Panama. *Nature Conservation*, 32: 81-101.
- Whitfeld, T.J.S., Novotny, V., Miller, S.E., Hrcek, J., Klimes, P. & Weiblen, G.D. (2012) Predicting tropical insect herbivore abundance from host plant traits and phylogeny. *Ecology* 93: 211-222.