

Diversity and Habitat Associations of Bees at Cusuco National Park

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Central America is considered one of the world's biodiversity "hotspots." However, compared to other regions of the world, there have been relatively few studies of Central American biodiversity, and there are many gaps in our knowledge of Central American ecosystems. Pollination is an essential ecological service, and bees are arguably the most important group of pollinators. Most studies of bee diversity have been done in temperate regions; tropical bees are much less thoroughly studied. This is particularly true for Honduras, which in terms of biological diversity is among the least studied countries in Central America. For example, Panama and Costa Rica each have almost 70 recorded species of orchid bees, but Honduras has less than 30. This disparity is undoubtedly due to a lack of bee research in Honduras, since Honduras has a great deal of habitat diversity and is much larger in terms of land area than either of the other two countries.

There is evidence that bee populations are declining in many parts of the world due to a variety of possible factors, with habitat destruction and fragmentation being of major importance. However, these effects could vary depending on the type of habitat disruption. For instance, in Central America, less ecologically damaging practices such as shade-grown coffee plantations may have less impact on bee diversity than more damaging practices such as clearing of forests for cattle grazing.

One obstacle to the study of bees is their tremendous diversity. There are roughly 20,000 described species of bees worldwide. Because of this great diversity, it can be difficult to get a grasp of the patterns in overall bee species composition. One group of tropical bees, the orchid bees, holds promise as an effective indicator group of overall bee diversity. While orchid bees are a fairly diverse group with over 200 species in the neotropics, their systematics and identification are relatively well known, and they can be effectively sampled using certain plant extracts as baits. By sampling overall bee diversity as well as orchid bee diversity in the same habitats, orchid bees can be evaluated as indicators of overall bee diversity. If overall bee diversity can be predicted based on orchid bee diversity, this would provide a relatively quick and easy method of monitoring bee diversity and its response to habitat and climatic changes.

Cusuco National Park (CNP) offers outstanding opportunities to increase our knowledge of tropical bee diversity and habitat associations, and effects of habitat destruction on this diversity. The major goals of this research are: 1) to inventory the bee diversity of CNP, 2) to analyze this diversity in relation to habitat variables such as canopy cover, altitude, habitat fragmentation, and type of disturbance, and 3) to evaluate the potential of orchid bees as an indicator group of overall bee diversity.

Bees will be sampled at sites chosen to provide a range of habitat types. Overall bee diversity will be sampled using a combination of malaise traps and pan traps. Malaise traps are flight intercept traps that are effective in sampling a variety of flying insect

groups including bees. These traps are constructed of fine mesh material with a central baffle and sloping roof that directs flying insects into a collection container. Pan traps are colored plastic bowls filled with preservative. Bees are attracted to the bowls and are trapped in the preservative. There is evidence that different colored bowls attract different bee species, so several bowl colors will be used.

Orchid bees will be sampled using various plant extracts such as eucalyptus oil, clove oil, wintergreen oil, and vanilla extract. These extracts are attractive to male orchid bees which collect the oils, probably using them as sex pheromones to attract females. The extracts will be employed in two ways: in saturated paper towel lures, with the attracted orchid bees collected using insect nets, and in McPhail traps. McPhail traps are commonly used in conjunction with attractants to trap flying insects. Collected bees will be taken back to camp, sorted into morphospecies, labeled and preserved by either pinning or in ethanol. Identification to species or the most specific level possible will be done as time and resources permit.

Bee diversity (overall and orchid bees) in relation to habitat variation will be analyzed using the multi-response permutation procedure (MRPP), a statistical technique for testing the hypothesis of no difference in species composition between two or more groups. MRPP provides a measure of within-group homogeneity, which increases as the species composition in different groups deviate, to a maximum of 1. Statistically significant MRPP results would indicate that different habitats harbor substantially different bee species assemblages. Patterns seen with MRPP will also be used to evaluate whether variation in orchid bee species composition among habitats mirrors that seen in overall bee diversity. Indicator species analysis, or ISA, will be used as a companion to MRPP to identify particular bee species that are strongly associated with particular habitats. ISA will measure the extent to which individual bee species are *exclusive* (never occurring elsewhere) and *faithful* (always present) to a particular habitat. Regression analysis will be used to evaluate the potential association between orchid bee and overall bee species richness.

This project offers numerous opportunities for student dissertation/thesis research. Students could do publishable research on the overall bee diversity of CNP as well as various aspects of bee habitat associations, effects of habitat disturbance, and orchid bees as indicator species. Students who are interested in more detailed studies of bee behavior and ecology might be interested in doing observational studies recording patterns in bee visitation to flowers. There will also be numerous possibilities to evaluate sampling methodology (effects of trap color and height on bee collections in pan traps, bee species collected in malaise vs. pan traps, effects of different plant extracts on species composition of orchid bee collections, orchid bee species collected by baiting/netting vs. McPhail traps, etc.). Opwall's canopy access training might also make it possible to sample forest canopy bees. Trap by-catches could also provide opportunities for student research on other insect groups such as robber flies, sphecid wasps, and parasitic wasps that are commonly collected in these traps.

Suggested Reading

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