Plant species evolved a way to determine most promising pollinator

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Heliconia tortuosa flowers

(Phys.org)—A trio of researchers has found that one species of flower is able to pick and choose when it comes to accepting pollen from a variety of pollinators. In their paper published in *Proceedings of the National Academy of Sciences*, Matthew Betts and Adam Hadley with Oregon State University and John Kress with the Smithsonian Institution, describe their study of *Heliconia tortuosa*, a flowering plant native to

Costa Rica, and what they discovered about its pollinating abilities.

Because they have no eyes, or brains to process visual information, it would seem that plants do not have much choice in which sorts of birds or insects transfer pollen to or from them, but in the case of one flowering plant, it appears a way has evolved nonetheless to ignore the pollen deposited by one species of bird, while favoring that from another.

As part of their study of the plant, the researchers found that it was not very receptive to being artificially pollinated, this got them wondering if the plants were as choosy with natural pollinators, so they captured several of them and released them into an aviary where they could be studied more closely. In tracking which flowers were visited by different types of humming birds and one type of butterfly, the researchers found a pattern—the plants seemed more receptive to the hummingbird species that had long curved beaks. Further testing confirmed their suspicions. But how could the plants demonstrate a preference? Suspecting it had to do with the longer bills, the researchers tried pollinating the plants with a longer pipette and found it a more successful technique. Taking their study further, they found that a longer pipette or bill on a bird allowed for sucking up more of the nectar the plant was offering, and that turned out to be the means by which the plant did its choosing—those that took more nectar were in turn more likely to see their pollen accepted by the plant.

The green hermit hummingbird extracts nectar from a Heliconia tortuosa flower.

As for why the plant would prefer long billed hummingbirds over those with short bills, the researchers suggest it is because those with long bills are the same species that travel farther while pollinating. That would mean the flower was more likely to receive pollen from a distant, unrelated plant, thus promoting diversity.

More information: Pollinator recognition by a keystone tropical plant Matthew G. Betts, *PNAS*, DOI: 10.1073/pnas.1419522112

Abstract

Understanding the mechanisms enabling coevolution in complex mutualistic networks remains a central challenge in evolutionary biology. We show for the first time, to our knowledge, that a tropical plant species has the capacity to discriminate among floral visitors, investing in reproduction differentially across the pollinator community. After we

standardized pollen quality in 223 aviary experiments, successful pollination of Heliconia tortuosa (measured as pollen tube abundance) occurred frequently when plants were visited by long-distance traplining hummingbird species with specialized bills (x^- pollen tubes = 1.21 ± 0.12 SE) but was reduced 5.7 times when visited by straight-billed territorial birds (x^- pollen tubes = 0.20 ± 0.074 SE) or insects. Our subsequent experiments revealed that plants use the nectar extraction capacity of tropical hummingbirds, a positive function of bill length, as a cue to turn on reproductively. Furthermore, we show that hummingbirds with long bills and high nectar extraction efficiency engaged in daily movements at broad spatial scales (~1 km), but that territorial species moved only short distances (