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Using Artificial Fruits to Decipher Agouti Seed Dispersal Decisions

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An agouti investigating thread-marked artificial fruits. The fluorescent thread and flagging tape allow me to track where the agouti takes each fruit and if it is eaten or hoarded. Photo Erin Kuprewicz

In tropical forests, seed dispersal by animals is a major mode of reproduction for many plant species (up to 90% of seeds are dispersed by animals in parts of the Neotropics!). In some cases, mammals act as the only dispersers for plants—these plants rely on effective dispersal by mammals to survive, colonize new environments, and reproduce. Interactions between ground-dwelling mammals and plants that produce large seeds are especially complex and interesting.

One species of mammal that is an important disperser and predator of many seed species in the tropics is the Central American agouti *(Dasyprocta punctata)*. Agoutis are large (2-4 kg) mammals that are common in the Wilson Botanical Garden and throughout the forests of Las Cruces Biological Station. Agoutis eat the fruits and seeds of many plants and exhibit a behavior that is important to the dispersal of large seeds: scatter-hoarding. Scatter-hoarding animals (like agoutis in tropical America and gray squirrels in the USA) save some seeds to eat later by burying them singly in many shallow caches underneath the soil. Sometimes, a scatter-hoarding animal forgets where it has buried a seed (or is eaten by a predator) and does not return to dig up and eat the underground seed; if this happens, that seed may germinate and grow into an adult tree, eventually producing seeds of its own to be dispersed by another scatter-hoarder. Despite being effective seed dispersers, an agouti's objective is not to "help" the plant—agoutis bury seeds to save them for later consumption, which kills the seed. Seeds that escape predation by agoutis are incidentally dispersed, but these rare events may be extremely important to plant life cycles and forest community dynamics.

By understanding how scatter hoarders decide whether to bury or eat a seed/fruit, we can determine how plant reproductive and defense strategies may influence seed survival and plant recruitment. However, studying these processes can be very difficult. Scientists studying seed-animal interactions require many seeds to track in space and time; sufficient fruits (of the same size) from one tree species may not be available in a given habitat because of low plant reproduction or high predation pressure by local seed-eating animals. I was able to bypass these logistic difficulties by creating artificial fruits made of peanuts and baked clay, which mimic natural seeds, can be made in large quantities, and can be modified to be any size and have any level of toxicity—these categories correspond with the hypotheses that the researcher wants to test. In this experiment, I tested how artificial fruits of different sizes (small=4g, medium=14g, large=24g) and with different levels of toxicity (0%, 2%, or 15% tannic acid) were treated by agoutis: what types of seeds do they preferentially eat or disperse? How do seed traits (like size or chemistry) affect agouti behaviors?

In this system, experimentally manipulating fruit functional traits using these artificial fruits worked very well: agoutis treated the artificial fruits as they would natural fruits and I was able to explicitly determine how fruit characteristics affect seed dispersal by agoutis. Overall, agoutis preferred to eat the smallest fruits immediately and hoard the largest ones, taking them far away from their initial locations (in one case 243m from the source!). Toxins had no effect whatsoever on agouti seed predation or dispersal behavior, regardless of tannic acid concentration.

These results are very interesting and even a little unexpected. Chemically-protected seeds can readily be eaten by agoutis despite their apparent toxicity and large seeds have much better chances of being hoarded and surviving to germination than small seeds. These findings have far-reaching implications for the evolution of seed size in plants as well as more local forest processes involving large mammals and seeds.