Build-A-Bee: The Effects of Body Size and Coloration on Bee Activity

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I. Principles introduced in this exercise

A. How are bee bodies adapted to different environments?

B. The importance of thermoregulation and flight.

C. The concept of keystone species.

II. Introduction

Many nectar gathering insects, like bees, are sensitive to temperature. They can't function when it is too cold and can overheat when temperatures are too hot. The general size and color of a bee affects its body temperature (think about wearing a black shirt vs. a white shirt on a hot day!), so knowing what color and what size a bee species is can help us figure out when (what time of day) and where (hot or cold climate) a certain bee will be active (Pereboom & Biesmeijer 2003). As far as size is concerned, it takes larger bees longer to get hot and longer to cool down, but they can reach higher overall body temperatures than smaller bees. Smaller bees heat up and cool down more quickly, and they can't get as hot as larger bees (Willmer 1983). Looking at body color, we find that lighter colored bees heat up slower than dark bees, but also can't get as hot their darker colored counterparts (Pereboom & Biesmeijer 2003). Thus, we would expect lighter, smaller bees to be active at higher temperatures and in warmer lowland *habitat*s (the place where an animal lives characterized by certain factors such as temperature, water distribution, and species composition. For example a mountain, desert, rainforest, or coral reef). Alternately, we would expect to see more activity from larger, darker bees at lower temperatures and cooler wetter habitat types such as mountains.

From this information we can see that bees, like many organisms, are very specifically adapted to a particular habitat. If the temperature of a bee's habitat changes (such as in the case of global warming) bees in that area may go extinct if their bodies cannot adjust to the new conditions. This can be bad news, not only for the bees, but for many other forms of life as well. That's because many types of bees are the only pollinator for certain plants, which makes them a *keystone species* (an organism that has a strong influence on the species composition of a habitat). To better understand the concept of a keystone species, lets consider the sea otter. In the ocean sea otters eat sea urchins, and sea urchins eat kelp. When the otter is over hunted by humans, there are less otters eating urchins, so the urchin populations grow large and eat all the kelp. In turn, kelp forests are feeding and nurturing grounds for fish, so with less kelp, there are less fish and thus less food for many of the sea creatures that eat fish. As you can see, the loss of a keystone species has a cascading effect that can influence many organisms and perhaps even lead to the extinction of some species. The loss of a keystone bee species could have similar drastic effects on a habitat. If a bee is the only pollinator for a plant (let's call it "plant X") in its habitat, and the bee is lost (it is out competed by honeybees introduced by humans for example), plant X can no longer reproduce since it is not being pollinated by its bee. Thus, plant X will start to disappear, and any other organisms that depend on plant X for food or a home will start to disappear as well.

This exercise will focus on identifying which types of bees are most likely to be active at a given temperature or found in a given habitat.

III. Materials & Methods

A. Look at the pictures and decide which one is more likely to be active in a hot dry habitat. Remember to pay careful attention to whether the bee is large, small, dark, or light.

B. Select the bee that would most likely be active in each of the given habitats.

IV. Sample Results

V. Sample Discussion Questions

VI. Sample Conclusions

VII. References

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