High-flying moths don't just go with the flow

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Enormous numbers of migratory moths that fly high direction.
above our heads throughout the night aren't at the mercy of the winds that propel them toward their final destinations, researchers report online on April 3rd in *Current Biology*, a publication of Cell Press. Rather, they rely on sophisticated behaviors to control their flight direction, and to speed their long-distance journeys into areas suitable for the next generation of moths.

While it isn't yet clear exactly how they do it, the researchers said the findings offer the first hard evidence for a compass in nocturnally migrating insects.

"There has been speculation for many years about whether insects that rely on the wind for their migrations can have any control over the direction in which they migrate," said Jason Chapman of Rothamsted Research in the United Kingdom. "If they don't have any control, in many years the majority of the autumn population would get blown in unsuitable directions and die—the so-called 'Pied Piper effect.' Our studies demonstrate that the moths can influence their direction and speed of movement in a number of ways."

First, they found, the moths migrate only on nights when the wind directions are broadly favorable—that is, blowing approximately toward the south. They then select their flying altitude so as to stay within the fastest winds, thus maximizing their speed. Third, they fly in a roughly downwind direction, adding their flight speed (of 5 m/s) to the wind speed and so moving even quicker. Most unexpectedly, Chapman said, the moths compensate when the wind direction is substantially off target.

That ability, called partial compensation for wind drift, had been observed previously in insects, such as butterflies and social bees, that fly just a few feet above the ground during the day, he added. The new study is the first to show that insect migrants flying high in the air on dark nights also use this method to beneficially influence their flight

"All these pieces of evidence together demonstrate that the moths must have a compass mechanism," similar to that found in migratory birds, he said.

Using entomological radar, the researchers estimated that in August 2003 about 200 million Silver Y moths migrated southwards over the U.K., traveling at more than 50 km per hour over distances in excess of 300 km per night.

"Considering the distances these moths would have flown, and their sophisticated orientation behaviors, it is apparent that many will have reached their over-wintering regions in just a few nights," the researchers concluded. "These results illustrate how nocturnal insects can migrate in seasonally advantageous directions even though they are reliant on windborne movement to travel the distances required, and we suggest that these mechanisms may prove to be widespread among large, windborne insect migrants. Considering the high pest status of many insect migrants, and the positive effects of global warming on the frequency of insect migration, the long-range movements of such pests will have increasing impacts on global agriculture, and therefore our ability to understand and predict their spatial dynamics will become progressively more important."

Source: Cell Press