Research pair uncover secret of hummingbirds' ability to fly in the rain (w/ Video)

July 19 2012, by Bob Yirka

Green Violetear at a flower. Image: Wikipedia.

(Phys.org) -- Hummingbirds are an interesting creatures. They dart around and fly like insects yet because they are warm blooded and cute, they inspire smiles in most who watch them. What's not so cute is watching an Anna hummingbird (*Calypte anna*) try to feed on the nectar in a flower during a heavy rain. Because the birds are so small, big rain drops, typical in the South American rain forest in the eastern Andes where they live, tend to look like liquid boulders dropping from the sky. Worse still is the additional weight the birds must carry as the raindrops make them wet. Still, the birds manage to work it out due to necessity.

Because of their small size and rapid wing beating, they have a very high metabolism rate that requires very frequent meals. To find out how they manage to fly in the rain, Victor Manuel Ortega-Jimenez and Robert Dudley from the University of California, working with the Smithsonian Tropical Research Institute, set the tiny birds in a clear plastic box, doused them with varying degrees of simulated rain and filmed the whole thing with a high speed video camera. They found, as they report in their paper published in the *Proceedings of the Royal Society B*, that the birds cope, mostly by changing their posture and working harder.

The two researchers filmed the birds undergoing simulated rain showers of various degree: light, moderate and heavy, and also with no rain at all to compare against. They found that under light or moderate rain conditions, the birds seemed to hardly notice the rain at all and flew much the same way as when conditions were dry. But when they turned up the tap, producing a lot of rain, the birds were forced to change tactics. They picked up the number of wing beats per second and adjusted their bodies into a more horizontal stance. They also raised and lowered their wings less.

At first the researchers were confused by the birds' actions, as a horizontal posture would mean more body area being bashed by the drops. But then, after watching the video over and over, they noted that in a more horizontal position, the birds were better able to adjust the angle of attack of their wings, and doing so also tended to reduce the amount of rain that actually struck their wings. Changing position then, appears to give the birds more power while still expending as little as nine percent more energy. The end result is a tiny bird that is able to fly and feed in all but the most torrential downpours.

More information: Flying in the rain: hovering performance of Anna's hummingbirds under varied precipitation, *Proceedings of the Royal Society B*, Published online before print July 18, 2012, doi: 10.1098/rspb.2012.1285

Abstract
Flight in rain represents a greater challenge for smaller animals because the relative effects of water loading and drop impact are greater at reduced scales given the increased ratios of surface area to mass. Nevertheless, it is well known that small volant taxa such as hummingbirds can continue foraging even in extreme precipitation. Here, we evaluated the effect of four rain intensities (i.e. zero, light, moderate and heavy) on the hovering performance of Anna's hummingbirds (Calypte anna) under laboratory conditions. Light-to-moderate rain had only a marginal effect on flight kinematics; wingbeat frequency of individuals in moderate rain was reduced by 7 per cent relative to control conditions. By contrast, birds hovering in heavy rain adopted more horizontal body and tail positions, and also increased wingbeat frequency substantially, while reducing stroke amplitude when compared with control conditions. The ratio between peak forces produced by single drops on a wing and on a solid surface suggests that feathers can absorb associated impact forces by up to approximately 50 per cent. Remarkably, hummingbirds hovered well even under heavy precipitation (i.e. 270 mm h^{-1}) with no apparent loss of control, although mechanical power output assuming perfect and zero storage of elastic energy was estimated to be about 9 and 57 per cent higher, respectively, compared with normal hovering.

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