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INSIDE JEB

Age and activity take their toll on house fly wings

Two house flies, one with little wing damage (right) and one (left) with significant wing loss. Photo credit: Henja-Niniane Wehmann.

Choosing a name can be stressful, so some creatures have simply ended up with literal monikers. Sloths, dung beetles and anteaters pretty much do what their names suggest; or at least they do in English. And then there's the humble fly. Where would these insects be without their wings? This is a question that Fritz-Olaf Lehmann from the University of Rostock, Germany keeps asking. How does the wear and tear that fly wings endure come about? Do the delicate structures simply become more fragile and disintegrate with age, or are they vulnerable to the knockabout of flight and collisions, accumulating damage over time? To find out where and how house flies accumulate damage to their wings, Henja-Niniane Wehmann, Thomas Engels (both from the University of Rostock) and Lehmann teamed up to identify which factors take the greatest toll on house fly wings and how much damage individuals can sustain before they can no longer remain aloft.

Initially, Wehmann placed groups of four house flies (*Musca domestica*) together in small (130 cm^3) plastic tubes for their entire lives, monitoring their activity by listening in as the insects buzzed while flying. In addition, she anaesthetised the tiny inhabitants three times a week to trace the outline of their wings and check their deterioration under a microscope. As well as cramming flies together, Wehmann also kept 20 of the insects in a larger mesh enclosure – providing 2000 times more space – regularly photographing them to find out how much of a toll the alternative lifestyle took on their wings.

Recording almost 7.7 million flights, ranging from as little as 0.03 s (five wing beats) to 0.92 s for females, but only up to 0.79 s for the males, Wehmann and Engels realised that the insects' wings first began incurring damage at the tips and rear edges of the fragile transparent membrane, becoming more ragged. However, after about 6 h of flight, the wings began showing signs of really catastrophic damage, fracturing along the front edge and losing larger portions. One fly lost almost 90% of a wing over one calamitous 3 day period.

Yet, while there were some clear losers, there were also winners. Some of the closely caged insects lost only 15% of their wing area over their lifetime, while others were left with almost non-existent stubs by the time they died. Also, the flies that were living in the most cramped conditions suffered damage 20 times faster than the insects that had a spacious cage to explore, confirming that impacts contribute significantly to incurred wing damage.

In contrast, some of the grounded flies appeared to have lost only 10% of their wing area, while others still managed to remain aloft, having lost as much as 34% of their initial wing area. And when Wehmann plotted the insects' ages against their ability to fly, it was clear that the most elderly flies were the most likely to have lost the power of flight; age in addition to wear and tear, is a clear risk for wings.

So, use and getting old both take a toll on the fragile structures that carry flies through the air, but the team suspects that other factors also play a role. For example, once a vein has become damaged, the wing may dry out faster, leaving it more vulnerable to damage from even the gentlest knock, accelerating the process. Wehmann also warns researchers that they shouldn't rely on the state of an insect's wings to estimate its age: 'the variability between wings and individuals is too great', she explains.

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