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Why are long sequences of steady flight less common at higher speeds of forward flight in Hawkmoth?[1] CHENGYU LI, MICHAEL CORBI, Villanova University, TYSON HEDRICK, University of North Carolina at Chapel Hill — The hawkmoth is able to sustain a steady hover or level flight at lower speeds (0˜2 m/s). However, previous wind tunnel experiments suggested that long sequences of steady forward flight were less common at higher flying speeds (>2.0 m/s) despite changes to the flight posture and muscle recruitment. Considering hummingbirds have about the same body size and can easily achieve ˜10 m/s forward flight speed, it is unclear why hawkmoths were not observed achieving steady fast flight. In this work, high-speed photogrammetry and 3D surface reconstruction were used to investigate a hawkmoth's (Manduca sexta) wing kinematics at a forward flight speed of 4 m/s. The associated fluid dynamics and wing aerodynamic performance were then studied using an in-house computational fluid dynamics solver. Quantitative analysis has shown a significant amount of negative lift was generated during upstrokes at this high forward flying speed. Such a negative lift in the upstroke might reduce maximum sustained flight speeds in this species and might represent an adaptation for the hovering feeding mode for which this species is known.

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