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A Study of the Aerodynamics of Small Insect Flight ARVIND SANTHANAKRISHNAN, LAURA MILLER, UNC Chapel Hill, WILLIAM DICKSON, MICHAEL DICKINSON, California Institute of Technology — The lift production in the flapping flight of fruit flies at Reynolds numbers of approximately 120 has been attributed to the generation of a stable leading edge vortex that remains attached during the entire stroke of its motion cycle (see Birch et al., J. Exp. Biol., 2004). Little is known, however, about the aerodynamics of flight in the smallest flying insects such as haplothrips (Re = 5). In this presentation, we consider Reynolds numbers from 1 to 80. We used quantitative experimental flow field and force measurements on a dynamically scaled model with angles of attack varying from 0 to 90 degrees. The three-dimensional kinematics of the actual insect flight is simplified herein, and the motion of the wing in pure translation and rotation are considered. In the context of vortex dynamics, two interesting regimes are observed in the flow field: a stable leading edge vortex and a detached trailing edge vortex at the higher end of Re, and attached leading and trailing edge vortices in the lower end of Re. The implications of these flow field regimes in relation to the lift production and the biological limit of flying insects will be presented.

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