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A drag-based mechanism for vertical force production in the smallest flying insects SHANNON JONES, RYAN LAURENZA, LAURA MILLER, UNC-Chapel Hill — Previous work has shown that the flight kinematics and aerodynamics of the smallest flying insects may be significantly different than that of their larger counterparts. These small insects, such as thrips and parasitoid wasps, are on the order of 1 mm in length and operate at a Reynolds number less than 10. Due to their small size and high wing beat frequency, quantitative data on the wing kinematics of the smallest insects is not available. As a result, there has been much debate and speculation about the flight strategies employed by these insects. With the challenges associated with generating lift at low Reynolds numbers, it could be beneficial for the smallest insects to use a drag-based motion to generate some or all of its vertical force, however this has not been rigorously investigated. We used computational fluid dynamics to investigate the feasibility of drag-based propulsion in the tiniest insects. We investigated the vertical force generated by an idealized drag-based vertical stroke over a range of Reynolds numbers from 1 to 150. We also compared this stroke to more conventional hovering stroke kinematics such as that of a fruit fly and dragonfly.

Shannon Jones
UNC-Chapel Hill

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