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Effect of varying solid membrane area of bristled wings on clap and fling aerodynamics in the smallest flying insects MITCHELL FORD, VISHWA KASOJU, ARVIND SANTHANAKRISHNAN, Oklahoma State University — The smallest flying insects with body lengths under 1.5 mm, such as thrips, fairyflies, and some parasitoid wasps, show marked morphological preference for wings consisting of a thin solid membrane fringed with long bristles. In particular, thrips have been observed to use clap and fling wing kinematics at chord-based Reynolds numbers of approximately 10. More than 6,000 species of thrips have been documented, among which there is notable morphological diversity in bristled wing design. This study examines the effect of varying the ratio of solid membrane area to total wing area (including bristles) on aerodynamic forces and flow structures generated during clap and fling. Forewing image analysis on 30 species of thrips showed that membrane area ranged from 16%-71% of total wing area. Physical models of bristled wing pairs with ratios of solid membrane area to total wing area ranging from 15%-100% were tested in a dynamically scaled robotic platform mimicking clap and fling kinematics. Decreasing membrane area relative to total wing area resulted in significant decrease in maximum drag coefficient and comparatively smaller reduction in maximum lift coefficient, resulting in higher peak lift to drag ratio. Flow structures visualized using PIV will be presented.

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