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A 3D computational fluid dynamics study of the swimming of the larva of mosquito (Chironomus plumosus). BOWEN JIN, Beijing Computational Science Research Center, HAOXIANG LUO, Vanderbilt University, YANG DING, Beijing Computational Science Research Center — The larva of Chironomus plumosus has a cylindrical body with a length about 14mm. Experiments have shown that it swims by periodically bending its body into a circle (the head and tail nearly in touch) and then unfolding it. However, the propulsion mechanism of the larva is not well understood. Here we use 3D computational fluid dynamics to simulate the swimming of the larva. According to the experimental observations of the movement pattern, the centerline curvature κ is prescribed in the form of a sinusoid function. The rotational and translational velocities are obtained by coupling the body with the fluid. The simulation results show that the greatest force and thrust are generated on the head and tail during the unfolding stage. By adjusting the time fraction γ of the unfolding stage, we find that both the swimming speed and the energetic efficiency increase with decreasing γ. However, the difference in swimming speed is only significant at intermediate Reynolds number (Re$\approx$1000). When Reynolds number increases (Re$\approx$3000) or decreases (Re$\approx$30), the difference in speed becomes smaller. Our study suggests that the kinematics of the larva of mosquito is specialized for swimming at intermediate Reynolds numbers.

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