Title:	Optical probing of long-range spatial correlation and symmetry in complex biophotonic architectures on transparent insect wings
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Abstract:	We experimentally probe the structural organization of complex bio-photonic architecture on transparent insect wings by a simple, non-invasive, real-time optical technique. A stable and reproducible far-field diffraction pattern in transmission was observed using collimated cw and broadband fs laser pulses. A quantitative analysis of the observed diffraction pattern unveiled long-range quasi-periodic order in the arrangement of the microstructures over mm scale. These observations agree well with the Fourier analysis of SEM images of the wing taken at various length scales. We propose a simple quantitative model based on optical diffraction by an array of non overlapping microstructures with minimal disorder which supports our experimental observations. We observed a rotation of the original diffraction profile by scanning the laser beam across the wing sample which gives direct signature of organizational symmetry in microstructure arrangements at various length scales. In addition, we report the first optical detection of reorganization in the photonic architecture on the Drosophila wings by various genetic mutations. These results have potential for the design and development of diffractive optical components for applied photonics and may open up new opportunities in biomimetic device research
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