Does Constant Blue or Orange Light Accelerate Butterfly Development?

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Light pollution or artificial light at night (ALAN) can disrupt insect circadian rhythms and development, since photoperiod is a dominant cue for timing seasonal events in animal life cycles. Previously metamorphosis was accelerated in painted lady (Vanessa cardui) caterpillars exposed to 24 h/day of white LED light. Butterflies and moths are sensitive to short wavelength (400-450 nm) blue light, so the hypothesis tested herein was that V. cardui caterpillar to chrysalis to butterfly development will be slower with constant exposure to long wave length orange (624 nm) LED light versus blue or cool white LED lights. This was tested in 3 experiments done in July, August and September, 2022. Each had four treatment groups: Exposure to 24 h white (positive control), 11:13 h light-dark cycle (no ALAN control), 24h blue (experimental 1) or 24h orange (experimental 2) lighting. Temperature was 70-72°F, light intensity was 300 lux, and caterpillar starting weights did not differ across treatments for each experiment. The results were that ALAN had no effect on chrysalis formation rate in any experiment, which was (mean ± SEM) 120 ± 3 h, 92 ± 1 h, and 106 ± 2 h for experiments 1-3. Yet caterpillars under orange light developed slower into emergent butterflies (304 ± 5 h) in experiment 1 than 11h white light controls (273 ± 4 h), and more slowly (252 ± 3 h) than ones exposed to constant white light (240 ± 3) in experiment 2. Hence orange ALAN appears less disruptive than white ALAN for caterpillars.

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