Universal Protection for Insects From the Harm of Artificial Lighting due to Positive Phototaxis

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Artificial lighting significantly reduces insect populations, contributing to their mass extinction alongside habitat loss, pollution, invasions, and climate change. This project aims to develop a universal and effective insect protection system against light traps. A lampshade-shaped device was created, combining three methods: 1. Ultrasound repelling. Based on research on seven insect taxa adapting to bat predation, ultrasound (US) was proven effective for repelling. Bat frequencies were measured in open areas and urban environments, considering Doppler shifts. The optimal frequency was found, achieving 67% efficiency. A US emitter with a thermocouple auto-shutdown for cold seasons and a spherical US generator for large light sources was proposed. 2. Disrupting insect flight paths. Analysis of insect attraction to light, relying on menotaxis and high-speed imaging, showed their tendency to align their backs to the light (especially sky-like spectra). A lampshade with blue windows was designed to exploit this behavior. The effect of centrifugal acceleration on the vestibular system was studied to optimize window placement. Tests confirmed blue-spectrum beams at various angles disrupt flight trajectories. 3. "Artificial sky" effect. A blue ring at the bottom of the lampshade helps insects regain proper orientation and exit the danger zone, especially near intense light sources, reducing harm. The combined device reduced insect presence at light sources by nearly 81% and proved effective in various conditions. I aim to develop and implement legal standards for outdoor lighting that are less harmful to insects.

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