

# IMPACTS OF DIFFERENT KINDS OF LIGHT POLLUTION ON THE DEVELOPMENT AND FLIGHT-TO-LIGHT BEHAVIOR OF TWO MOTH SPECIES

## **Abstract:**

The day-night cycle is one of the most regular and predictable one in nature, every evening the sun sets and every morning the sun rises. Moreover, modifications of the length of day or the length of night are correlated with seasonal variations of temperature. Organisms adapted to this day-night cycle and associated variations with an internal clock, the circadian cycle. Some organisms active during the night, like most moths, have developed a positive phototaxy to orientate, for example by following the moon.

But humans have introduced artificial light at night (ALAN) into the environment that stays turned on during all or nearly all the night. This ALAN is harmful to a lot of organisms and is responsible for a kind of pollution: light pollution. Light pollution can be split into three forms. The first one is fixed light pollution (e.g. streetlights), comprising intense sources of light always turned on during the night. It disturbs the circadian cycle, attracts moths and increases their susceptibility to predation. The second kind of light pollution is skyglow that makes the sky brighter than it should be and hides the stars (for most humans too). The last one is non-constant light pollution that comes from light sources that are not always turned on or at the same place during all the night. It comprises, for example, smart streetlights, that are becoming more and more frequently used. But the impacts of this one is not understood yet.

Therefore, we did an experiment with two moth species: *Agrotis exclamationis* and *Ochropleura plecta* (Lepidoptera: Noctuidae), we took female individuals from gardens in two different Belgian regions. The Luxembourg one with a low skyglow and the Brabant one with a high skyglow. We raised the offspring in three experimental conditions: a fixed light pollution one, a non-constant light pollution one and finally a control one. We studied the development (speed of development and evolution of their weight) until the end of the adult phase, and their flight to light behavior. As far as we know, we are the first study on the flight-to-light behavior following a breeding experiment under different kinds of light pollution.

Our results suggest that, in contrast to the scientific literature, fixed light pollution increases the developmental time and the mass of moths compared to the control condition. Individuals raised under fixed light pollution shown a stronger flight-to-light behavior than the others treatments. We failed to show differences between the non-constant light pollution treatment and the control one, suggesting a low impact of smart streetlights. Finally, we obtained some indications that there is a possible evolution of populations living in a high skyglow environment because they show weaker responses to the light pollution treatments compared to the ones living in a low skyglow environment.