

New study reveals how day- and night-biting mosquitoes respond differently to colors of light and time of day

July 28 2020



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In a new study, researchers found that night- versus day-biting species of mosquitoes are behaviorally attracted and repelled by different colors of

light at different times of day. Mosquitoes are among major disease vectors impacting humans and animals around the world and the findings have important implications for using light to control them.

The University of California, Irvine School of Medicine-led team studied mosquito species that bite in the daytime (*Aedes aegypti*, aka the Yellow Fever mosquito) and those that bite at night (*Anopheles coluzzi*, a member of the *Anopheles gambiae* family, the major vector for malaria). They found distinct responses to [ultraviolet light](#) and other colors of light between the two species. Researchers also found light preference is dependent on the mosquito's sex and species, the time of day and the color of the light.

"Conventional wisdom has been that insects are non-specifically attracted to ultraviolet light, hence the widespread use of ultraviolet light "bug zappers" for insect control. We find that day-biting mosquitoes are attracted to a wide range of light spectra during the daytime, whereas night-biting mosquitoes are strongly photophobic to short-wavelength light during the daytime," said principal investigator Todd C. Holmes, Ph.D., a professor in the Department of Physiology and Biophysics at the UCI School of Medicine. "Our results show that timing and light spectra are critical for species-specific light control of harmful mosquitoes."

The new study titled, "Circadian Regulation of Light-Evoked Attraction and Avoidance Behaviors in Daytime- versus Nighttime-Biting Mosquitoes," is published in *Current Biology*. Lisa S. Baik, a UCI School of Medicine graduate student researcher who recently completed her Ph.D. work, is first author.

Mosquitoes pose widespread threats to humans and other animals as disease vectors. It is estimated historically that diseases spread by mosquitoes have contributed to the deaths of half of all humans ever to

have lived. The new work shows that day-biting mosquitoes, particularly females that require blood meals for their fertilized eggs, are attracted to light during the day regardless of spectra. In contrast, night-biting mosquitoes specifically avoid ultraviolet (UV) and blue light during the day. Previous work in the Holmes lab using [fruit flies](#) (which are related to mosquitoes) has determined the light sensors and circadian molecular mechanisms for light mediated attraction/avoidance behaviors.

Accordingly, molecular disruption of the circadian clock severely interferes with light-evoked attraction and avoidance behaviors in [mosquitoes](#). At present, light-based insect controls do not take into consideration the day versus night behavioral profiles that change with daily light and dark cycles.

"Light is the primary regulator of circadian rhythms and evokes a wide range of time-of-day specific behaviors," said Holmes. "By gaining an understanding of how insects respond to short wavelength [light](#) in a species-specific manner, we can develop new, environmentally friendly alternatives to controlling harmful insects more effectively and reduce the need for environmentally damaging toxic pesticides."

More information: Lisa S. Baik et al, Circadian Regulation of Light-Evoked Attraction and Avoidance Behaviors in Daytime- versus Nighttime-Biting Mosquitoes, *Current Biology* (2020). [DOI: 10.1016/j.cub.2020.06.010](#)

Provided by University of California, Irvine

Citation: New study reveals how day- and night-biting mosquitoes respond differently to colors of light and time of day (2020, July 28) retrieved 24 May 2024 from <https://phys.org/news/2020-07-reveals-day-night-biting-mosquitoes-differently.html>

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