# Malaria mosquitoes track day length to anticipate annual dry seasons

**Diana L. Huestis**
**Monica L. Artis**
**Peter A. Armbruster**
**Tovi Lehmann**

**Video Abstract**

**Keywords:** mosquitoes, surface water, life cycle, dry season, water, Sahelian, Anopheles, environment, malaria

**Posted Date:** September 20th, 2019

**DOI:** https://doi.org/10.21203/rs.2.15076/v1

# Abstract

Thousands of mosquito species inhabit our planet, and for most, surface water is essential to their life cycles. Despite this, many species seem to persist in areas with long dry seasons – even when no water is available to support new offspring. To uncover the tactics mosquitoes use to endure these seasons, a U.S.-based research team has begun pinpointing the environmental cues the insects rely on to detect approaching dry weather. By exposing the insects to these cues in the lab, they've uncovered some of the strategies mosquitoes use to survive. The team focused on two species that transmit human malaria: Anopheles arabiensis and Anopheles coluzzii. In their home range of sub-Saharan Africa, both species withstand annual dry seasons lasting from 4 to 7 months. Anopheles arabiensis is thought to accomplish this through long-distance migration from areas with permanent standing water. Anopheles coluzzii, on the other hand, is thought to hunker down and enter a state of dormancy known as aestivation – much like how mammals hibernate. To determine how these mosquitoes ride out dry weather, the team had to first investigate how they identify changing seasons. To do this, they brought eggs of wild-caught mosquitoes back to the lab and raised their offspring under controlled conditions. Under constant temperatures, the offspring were either exposed to a gradually decreasing day length – or photoperiod – to mimic the transition from the wet to dry season, or they were raised with stable photoperiods to simulate wet and dry seasons well underway. Tracking the insects' growth and development revealed two very different responses. For Anopheles coluzzii, shorter days sped up development into adulthood, produced a larger body size, and most importantly increased longevity – all potential signs that the insects were preparing to enter aestivation. Anopheles arabiensis on the other hand slowed their maturity into adulthood and developed into smaller adults under dwindling daylight. And their lifespan did not change. These differences suggest the insects weren't preparing to face a dry season head on, supporting the idea that they migrate when water becomes scarce. Although aestivation and migration weren't fully replicated in the lab, the work underscores the influence of day length on the survival of tropical mosquitoes during changing seasons. Importantly, knowing how the insects endure extended dry spells may help reveal new control strategies to reduce the burden of mosquito-borne disease.