

Effects of temperature fluctuations and humidity variation on survival of two *Anopheles* malaria mosquito species

Mauro Pazmiño-Betancourth¹, Fredros O Okumu^{1,2}, Simon A Babayan¹, Francesco Baldini^{1,2}

¹School of Biodiversity, One Health and Veterinary Medicine, University of Glasgow, UK, G12 8QQ

²Department of Environmental Health and Ecological Sciences, Ifakara Health Institute, Ifakara, Tanzania

Increased global temperatures and frequency of extreme weather events are predicted to impact the ecology of mosquitoes and their ability to transmit vector-borne diseases. While most laboratory studies rear mosquitoes under constant temperature (CT), the effects of fluctuating temperature (FT) on mosquito ecology remain limited. Here, we measured the effects of CT and FT temperatures and humidity variation on the life history traits of two malaria mosquito species, *Anopheles gambiae* and *An. coluzzii*. Mosquitoes were reared at two mean temperatures (27 °C and 24 °C) either constant or with two different diurnal temperature ranges (DTR) of ± 3 and ± 6 °C; and under two humidity levels (50% and 80% RH). Mosquitoes were also exposed to a sublethal dose of deltamethrin or a control treatment to assess the influence of environmental variation on insecticide susceptibility. Larval survival and developmental time, and adult survival and body size were measured. We found that in larvae, *An. gambiae* survived better under FT and *An. coluzzii* performed better under CT while in adults, this pattern reversed. *An. coluzzii* adults survived longer and were larger under FT and *An. gambiae* adults did better under constant conditions. Additionally, as temperature, DTR and humidity increased, adult survival decreased, regardless of the species. Moreover, while insecticide exposure reduced survival under high humidity, no detrimental effect was observed at 50% RH. These results show that daily temperature fluctuations and humidity strongly influence mosquito survival and insecticide tolerance, with important implications for vector-borne disease modelling and mosquito rearing protocols.