

Optimal efficacy in mosquito-host interaction inhibition by 35-60 kHz animal sounds for malaria control

Abstract

Female *Anopheles gambiae sensu stricto*, the malaria vector, continues to develop resistance to synthetic insecticides thus threatening its control. Studies on mosquito's phonotaxis showed that the electronic mosquito repellent (EMR) (40-55 kHz) sound, *Odorrana tormota* (35-60 kHz) sound and winded-EMR sound yielded 68.99%, 45.88% and 60.70% repellency respectively, supporting feasibility of non-pollutant sounds in mosquito control. Rudimental studies with *O. tormota* sounds didn't observe protocols for mosquito rearing standard operation procedures (SOPs) and World Health Organisation (WHO) guidelines for efficacy testing of spatial repellents. Also, phonotactic inhibition by natural sounds of *Delphinapterus leucas* and male *A. gambiae s.s* had not been studied. This research, therefore, determined spatial activity index (SAI) and protection index (PI) of mated female *A. gambiae s.s* evoked by 35-60 kHz sounds of *O. tormota*, *D. leucas*, and male *A. gambiae s.s* in adherence to mosquito rearing SOPs and WHO guidelines. Mosquitoes were reared in Kenya Medical Research Institute (KEMRI) laboratories. Sounds of a hundred 3-5-day-old male *A. gambiae s.s* were recorded using Avisoft recorder whereas the sounds of *O. tormota* and *D. leucas* were acquired. Abnormal mosquito behavioural responses were observed during the bioassays. The bioassay data was collected and analyzed using statistical softwares. Mean SAI evoked by *O. tormota*, male *A. gambiae s.s*, and *D. leucas* were 0.142, 0.318, and 0.206 respectively, indicating negative phonotaxis. The PI elicited by *O. tormota* was 80.06% exceeding male *A. gambiae s.s* and *D. leucas* by 1.65% and 8.24% respectively. The constant frequency modulated sound of *O. tormota* yielded mean bandwidth (mean entire; 13.95 kHz), maximum frequency (mean entire; 41.61 kHz), maximum energy (8.02 Pa²s), entropy (2.87 bits), delta power (24.10 dB), average power (55.60 dB), maximum power frequency (38.09 kHz) and maximum power (75.90 dB).

Authors:

Philip A Mang'are, Jacqueline K Makatiani, Samwel Rotich