
How to catch a malaria mosquito? Study and development of odour-baited traps.

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Blood-feeding insects such as mosquitoes rely on various sensory cues to detect their blood-hosts and approach these hosts undetected. Scientific knowledge on this host-seeking behaviour has been used to develop odour-baited traps specifically aimed at capturing anthropophilic mosquitoes. By using attractive odour blend and visual cues that simulate human presence, these traps are now effective tools for monitoring and controlling vectors of dangerous disease like malaria or the dengue fever. Although long-range attraction by such traps has already been studied, the short-range interaction of mosquitoes with these traps is not well characterized. These short-range interactions strongly affect capture performance of a trap, because it is these interactions that lead to capture or escape. Here, we present our study on the development of a novel mosquito trap with improved capture performance. Using stereoscopic high-speed videography, we studied the flight dynamics of mosquitoes around two widely-used odour-baited traps. This showed that a large majority of mosquitoes that interacted with the trap escaped because they did not approach the trap closely enough. Based on the results, and a series of design iterations, we developed a novel mosquito trap with additional short-range host-mimicking cues, namely heat and humidity. In a comparative study, performed in both laboratory conditions and semi-field conditions (in Tanzania), we showed that the new trap has a highly improved capture efficiency compared to the conventional traps. Finally, we used our high-speed videography system to show that our newly-added host-mimicking cues heat and moisture caused mosquito to approach the trap more closely, explaining the increase in capture performance. Because conventional odour-baited traps are already successfully used around the world, our greatly improved new trap design has the potential of becoming an important tool for fighting disease vectors such as malaria mosquitoes.