

**Development of a gravid mosquito trap for
surveillance of the malaria vector *Anopheles
gambiae s.l.* Giles (Diptera: Culicidae)**

BY

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ABSTRACT

This study was intended to develop a trap for surveillance of gravid malaria vectors, *Anopheles gambiae s.l.*, in outdoor venue.

First, a suite of tools were developed for studying the oviposition behaviour of gravid *An. gambiae s.l.* A square of four electric nets with yellow sticky film-mounted boards to collect electrocuted mosquitoes was developed as a tool to quantify gravid mosquitoes approaching an oviposition site. On average 33% (95% CI 28-38%) of mosquitoes released were recaptured with the e-nets. The electric net (e-net) setup was evaluated for any influence on the response of gravid mosquitoes to a pond it surrounds compared to distribution of mosquitoes in two similar ponds; it collected a higher proportion of mosquitoes (OR 1.7, 95%CI 1.1 - 2.7; $p < 0.017$). Following this, yellow boards placed around a pond were also tested and it attracted more mosquitoes as well (60.6% 95%CI 47.9 – 72.0). The combination of the yellow boards, the black pond at the centre and the surrounding floor might have formed a preferred contrast by the mosquitoes. The yellow film might not attract by itself as the mosquitoes hardly land on it compared with the transparent and shiny black surfaces (OR 41.6, 95% CI 19.8 – 87.3, $p < 0.001$ and OR 28.8, 95% CI 14.5 – 56.8, $p < 0.001$, respectively). Detergent and spray glue applied to water, insect glue applied on transparency and wire screen placed above the surface of the water (test for landing on the surface) and spray glue, yellow sticky film and transparent double-sided sticky film applied on the edge of artificial habitats were used to assess the mosquitoes' landing behaviour during oviposition. Over 80% of collected females were found on the water surface (Mean 103, 95% CI 93-115) as compared to the edge of the artificial pond (Mean 24, 95% CI 20-28).

The catching efficiency of commercially available gravid culicine traps were evaluated and the square of electric net was used to investigate the factors that are responsible for a reduced acceptability of gravid malaria vectors to approach these traps. Only less than 30% of released mosquitoes were recaptured per night by Box, CDC and Frommer gravid traps (59.3, 95% CI 50.3–70.0). The number of mosquitoes approaching the Box trap was significantly reduced when the trap was

positioned over a water-filled basin compared to an open pond (OR 0.7 95% CI 0.6–0.7; $p < 0.001$). Based on this result a new prototype trap (OviART gravid trap) that provides open landing space was developed for the collection of gravid malaria vectors. The catch was significantly increased with the OviART gravid trap both in semi-field and field systems (OR 1.6, 95%CI 1.2–2.2; $p = 0.001$; OR 3.3, 95%CI 1.5, 7.1 respectively) compared with the Box gravid trap.

In conclusion, a square of four e-nets with yellow sticky collection devices can be used for quantifying the numbers of mosquitoes approaching a small oviposition site. *An. gambiae s.l.* primarily land on the water surface for oviposition, a behaviour exploited for the development of an OviART gravid trap. The OviART gravid trap can be used as outdoor sampling tool for surveillance of malaria vectors.