Discovery of an oviposition attractant for malaria vectors of the Anopheles gambiae species complex paves the way for novel surveillance and control tools

Michael Okali1,2, Jenny Lindh3, Manuela Herrera-Varela1,2, Anna-Karin Borg-Karlson3, Baldwyn Torto1, Steven Lindsay4, Ulrike Fillinger1,2

1 International Centre of Insect Physiology and Ecology, Kenya; 2 London School of Hygiene and Tropical Medicine, UK; 3 Royal Institute of Technology, Sweden; 4 Durham University, United Kingdom

mokali@icipe.org

INTRODUCTION
Long-lasting insecticidal nets (LLINs) and indoor residual sprays (IRS) are the gold standard tools for malaria vector control in sub-Saharan Africa. However, to deal with residual malaria transmission sustained by mosquito populations that resist insecticides and bite or rest outdoors, supplementary tools that target malaria vectors outdoors have become a research priority (Killeen, 2014). This study tested the hypothesis that we can identify chemicals that guide gravid females of the Anopheles gambiae mosquito complex and combine them with traps to kill mosquitoes outdoors.

METHODS
• Headspace collections were done with soil infusions and autoclaved soil infusions previously described (Herrera-Varela et al., 2014; Okali et al., 2015);
• Volatile chemicals analysed with gas-chromatography mass-spectrometry; one volatile identified and evaluated in semi-field system with modified BG sentinel trap (a);
• Field tests in western Kenya, in Kaugge location, 200m from the shore of Lake Victoria;
• Three sites within the vicinity of houses, but 70 – 500 m apart;
• Three types of traps set in parallel: (a) modified BG Sentinel trap, (b) OvART gravid mosquito trap, (c) ring of electrocuting nets;
• Randomised block design;
• Half of each trap type treated with 5 ppm of cedrol in lake water;
• Traps run overnight;
• Three rounds implemented, 24 trap nights;
• Analysed with Generalized Linear Models.

CONCLUSION
As Anopheles gambiae species use attractive chemical cues when orienting towards oviposition sites, we can exploit these chemical cues to trap female malaria mosquitoes outdoors.

IMPACT
The discovery of cedrol and demonstration of its trapping efficacy is an important breakthrough for targeting gravid members of the An. gambiae complex. It provides for the development of multiple ways for targeting residual malaria transmission in areas where current gold-standard indoor vector control interventions are applied at full coverage, but are not enough to eliminate malaria.

OBJECTIVE
To develop and evaluate an odour-baited trapping tool for gravid mosquitoes of the Anopheles gambiae species complex.

RESULTS
Headspace collection and GC-MS analysis revealed four compounds (51, 263, 276, and 283) grouping closely with the soil infusion samples that had previously been shown to attract gravid females (Herrera-Varela et al., 2014) as compared to the same infusion autoclaved. We identified one of the volatiles, ID 276, as cedrol.

Anopheles gambiae s.s. were two times more likely to approach modified BG sentinel traps in the semi-field tests when water with 5ppm cedrol was provided than in water only [Odds ratio (OR) 1.9, 95% confidence interval (CI) 1.6–2.3].

Under natural field conditions, traps with 5ppm cedrol were three times more likely to trap Anopheles arabiensis than traps with water only (OR 3.3, 95% CI 1.4–7.9).

REFERENCES