The Gnatwork
Intended use of resource / data

Open access resources and data provided by The Gnatwork should be used for the intended purpose only, as specified below.

Title of resource

GN_28: Host Decoy Trap

Authored by

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When using this protocol, the following should be referenced:

Hawkes, F., Gibson, G. Seeing is believing: the nocturnal malarial mosquito *Anopheles coluzzii* responds to visual host-cues when odour indicates a host is nearby. *Parasites and Vectors* 9, 320 (2016). https://doi.org/10.1186/s13071-016-1609-z

Hawkes, F.M., Dabiré, R.K., Sawadogo, S.P. et al. Exploiting *Anopheles* responses to thermal, odour and visual stimuli to improve surveillance and control of malaria. *Scientific Reports* 7, 17283 (2017). https://doi.org/10.1038/s41598-017-17632-3

Abong'o, B., Yu, X., Donnelly, M.J. et al. Host Decoy Trap (HDT) with cattle odour is highly effective for collection of exophagic malaria vectors. *Parasites and Vectors* 11, 533 (2018). https://doi.org/10.1186/s13071-018-3099-7

DOI

N/A

Description

Host Decoy Traps for outdoor collection of hematophagous insects:

A) Experimental design, sample sizes and power calculations for trap evaluation
B) Host Decoy Traps
C) Processing samples collected on Host Decoy Traps

Intended use

Scientific research use and training purposes.

Restrictions on use

Content is not to be redistributed in the public domain (e.g. presentation, lecture, online or in publications).

Resource history

N/A

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A) Experimental design, sample sizes and power calculations for trap evaluation

When undertaking a preliminary evaluation of a new sampling methodologies, it is usually appropriate to employ a Latin square experimental design, with randomization. In a Latin square, each sampling method is allocated a discrete location, sufficiently distant from the other methods (normally a minimum of 50 m depending on the biology of the insect under study) and all sampling methods are tested simultaneously. Then each sampling method is randomly allocated to another of the locations previously occupied by another sampling method, and tested again. This is repeated until each sampling method has been tested in each location once. For example, if there are three sampling methods, they will each be tested in three locations, over three days (or nights if the target insect is nocturnal). This constitutes one replicate of a Latin Square; an example of a Latin square replicate for testing three sampling methods for collecting sandflies at night is shown below:

REPLICATE	EXPERIMENTAL NIGHT	DATE	SITE			Complete (Tick)
			A	B	C	
1	1	11-Mar-20	Human landing catch	CDC light trap	Host decoy trap	
	2	12-Mar-20	Host decoy trap	Human landing catch	CDC light trap	
	3	13-Mar-20	CDC light trap	Host decoy trap	Human landing catch	

Three Latin square replicates should be aimed for as a minimum. However, to have sufficient statistical power to analyse any difference in catch between the tools, more replicates are likely to be needed, and it is helpful to have some preliminary data that can be used to estimate how many using power calculations. Power calculations can be computed in 'R' statistical software, which is free to download. Use the package pwr (Cohen, 1988), where k = the number of groups, i.e. sampling methods to be tested, f = the effect size, or the estimated magnitude of difference in catch between methods, which can be calculated using Choen's *d* (the mean of one group, subtracted from the mean of another group, divided by their pooled standard deviation), and p = statistical power, between 0 and 1, representing the probability of accepting the alternative hypothesis if it is true, where the value is typically set at a minimum of 0.8 (i.e. 80%, meaning there is only a 20% chance of committing a Type II error; the higher the power the lower the likelihood of a false negative error). After inputting these values, the programme will output n, the suggested number of observations required per group. This provides a starting point for deciding how many replicates to complete, which will likely need to be balanced against other constraints and practicalities, including what resources are available to complete the experiment.

See: Cohen, J. (1988) Statistical power analysis for the behavioral sciences, 2nd ed., Hillsdale, NJ: Lawrence Erlbaum.

B) Host Decoy Traps

Host Decoy Traps can be made from commonly available materials, according to the protocol published online here: https://www.protocols.io/view/constructing-a-host-decoy-trap-for-malaria-vector-n95dh86 (dx.doi.org/10.17504/protocols.io.n95dh86).

Alternatively, a standardised prototype can be procured from Biogents AG by contacting them directly (https://eu.biogents.com/contact-biogents/).

Transparent adhesive sheet produced by Rentokil called Fics Film mk 1, suitable for use with HDTs and in other insect sampling approaches, can be procured from Barrettine Environmental Health (https://www.barrettineenv.co.uk/1/home). One roll is sufficient to cover the Biogents prototype HDT approximately six times (i.e. six uses).

C) Processing samples collected on Host Decoy Traps

Several approaches to processing insects from the sticky trap surface of HDTs have now been trialled in the field. In most cases, it is possible to morphologically identify insects while still attached to the sticky plastic. On occasion, a diagnostic feature may be obscured and require extraction, or downstream dissection or molecular assays are required. The most suitable method for extracting samples will depend on the study requirements. The options are as follows:

i. Cover the adhesive surface with transparent food wrap (also known as cling film, polythene roll and Saran wrap), so that the specimens are sandwiched in a later between the sticky plastic sheet and the food wrap. These can then be easily moved to a field or central laboratory and stored in a freezer if necessary. A sharp pair of scissors or scalpel can be used to cut a disc around a sample and the disc placed into 2-3 drops of solvent (e.g. vegetable oil, Mobe Moat glue solvent). Using fine-tipped forceps and a probe, the layers can be peeled apart, and the specimen removed to a piece of cotton to dry and stored as dry samples with silica gel. Culicid specimens removed in this way have successfully been subject to PCR for species identification and malaria parasite detection.
ii. Place the sticky sheet on a flat surface. Use a pair of forceps dipped in solvent to pick up a drop of solvent, then place this on top of two or three specimens. Leave for about 20 seconds and then carefully extract the sample to a cotton pad to dry and store as dry samples with silica gel. Phlebotomid specimens removed in this way have successfully been subject to RPA for leishmania parasite detection.
iii. With the sample in situ on the sticky plastic, carefully dissect as required. Simuliid specimens have been successfully dissected for the presence of *Onchocerca* species larvae.

No instances have yet occurred where molecular analysis has been impeded by either the solvents or residues from the adhesive on the trap.