

Constructing a Host Decoy Trap for malaria vector sampling

Frances Hawkes, Simon Sawadogo, Roch Dabiré, Steve Torr, Gabriella Gibson

Abstract

Host Decoy Traps (HDT) sample outdoor-biting mosquitoes and have potential as a monitoring malaria vectors. The trap emits human odour, is visually conspicuous and heated to human body temperature, thus mimicking a human host, and therefore, it catches a proportion of the number of mosquitoes that would land on a host with the same characteristics. For example, at low population densities of *Anopheles coluzzii*, the HDT can catch 1.5x that of a standard human landing catch, and in the rainy season this increased dramatically; the HDT can catch 10x the number in a human landing catch.

The trap consists of an adhesive trapping unit and an odour source. Human odour from a volunteer in a tent is blown down the plastic pipe and around the warm visually conspicuous trap. Mosquitoes are attracted to the odour. The high visual contrast of the black trap against the soil is seen by mosquitoes and they fly close to the trap to determine if it is the host. At close range, mosquitoes detect the relative warmth of the trap compared to the ambient air temperature and this induces landing in search of a suspected host, causing the mosquito to become stuck on the adhesive plastic surface.

Citation: Frances Hawkes, Simon Sawadogo, Roch Dabiré, Steve Torr, Gabriella Gibson Constructing a Host Decoy Trap for malaria vector sampling. **protocols.io**

dx.doi.org/10.17504/protocols.io.n95dh86

Published: 06 Apr 2018

Protocol

MATERIALS

Step 1.

- **One-person tent:** To house human volunteer providing natural whole-human odour, which includes carbon dioxide. Tent should have as few air vents as possible, so that there is enough ventilation, but most of the host's odours will be extracted by the fan in the pipe.
- **Fan and 6V battery:** Fan can be of the type used to cool computers.
- **10 m UPVC drainage pipe (10-20 cm diameter) + mosquito net covering at one end:** length can be adjusted according to the needs of the experiment.
- **Metal cooking pot or plastic barrel/container (40 l) with lid:** typical dimensions would be 40 cm high, 45 cm diameter, though smaller containers will work.
- **15-20 l hot water,** to go inside pot. Water should be approximately 80 degrees C when poured into pot.
- **Heat source for water:** Electrical element, plumbed hot water, supply charcoal/wood fire, propane burner, etc.
- **Infra-red spot thermometer:** hand-held unit to detect temperature of surfaces at a distance

to record temperature of trap surface area and ambient air temperature. E.g. UNI-T UT301C Infrared Thermometer.

- **Towelling material to insulate container:** Exterior surface should be 30-40°C (or at least a few degrees above ambient air temperature), as measured by a spot thermometer. Use two layers of towelling wrapped around the container tightly and smoothly (i.e. no air gaps, which would produce 'cold patches') to insulate the container. This can be held in place with safety pins, or sewn together so the container can be slipped into the towel cylinder.
- **Black fabric 'jacket' to fit around pot and lid:** ideally sewn to fit over the cooking pot hugging close to the pot's sides and top. Can be made from cotton, poly-cotton, polyester, nylon. The aim is to give the pot a strong visual contrast against the background of soil and/or vegetation; i.e. pot is either 1) darker than everything around it and/or 2) pot is a solid colour, with no pattern on it.
- **FICS Film adhesive roll:** To wrap around trap circumference and catch landing mosquitoes. Available for international delivery from <http://www.barrettine.com/Environmental-Health/>, worldwide delivery.
- **Plastic "Food wrap":** Also called Saran wrap, cling film, catering wrap, or any thin transparent plastic sheet to cover adhesive sheet at the end of the sampling period.
- **Mobe Moat solvent:** To remove mosquitoes from the adhesive roll. Available for international delivery from <http://www.barrettine.com/Environmental-Health/>.
- **Other small items:** wire, metal clips, strong scotch tape/duct tape, scalpels/ scissors, permanent pen, plastic bag.
- **Adult volunteer:** To sleep inside the tent and provide natural host odours.

ASSEMBLING THE HOST DECOY TRAP

Step 2.

1. Fill the cooking pot/container with hot water - the starting water temperature should be around 80°C. With adequate insulation, this should be sufficient to maintain the exterior surface of the trap at 30-40°C, the temperature at which *An. gambiae* has demonstrated increased landing rates.
2. Wrap towelling around container (base, sides and top) and place black jacket over the whole assembly. Use metal clips or safety pins to hold fabric in place. Place pot in position - about 15 cm from odour source.
3. Wrap FICS Film adhesive sheet around the outside of the trap (adhesive side facing outwards) and stick the sheet to itself to keep the sheet in place. Cut the sheet free from the roll with a disposable scalpel. Use a small strip of scotch tape to hold the top and bottom of the sticky plastic in place, if needed. Scissors cannot easily be used because the blades get stuck together very quickly.
4. Use a permanent pen to write date and position of the trap on the top of the non-sticky border of the FICS film roll. If possible, align the trap so the writing is directly opposite the odour source - this helps interpret mosquito landing in relation to the odour source and wind direction.

PREPARING THE ODOUR SOURCE

Step 3.

1. Erect the tent.
2. Attach fan to one end of the UPVC pipe using a plastic bag to seal the two together if needed, with scotch tape and wire. Make sure fan blows air out of the tent and down the pipe. Place fan end of pipe inside tent with the 6V battery.
3. Put mosquito net around the other end of the pipe using scotch tape to prevent mosquitoes

flying up the pipe and into the tent.

ASSEMBLING THE TRAP AND ODOUR SOURCE

Step 4.

1. Ask the first volunteer to enter the tent.
2. Connect fan to 6V battery.
3. Close door of tent tightly around the UPVC pipe. The fan should suck air from inside the tent, and blow it down the pipe.
4. Place the Host Decoy Trap unit approximately 15 cm away from the mosquito net at the other end of the pipe.

REMOVING SAMPLES FROM THE TRAP

Step 5.

1. At the end of the experimental period, wrap thin plastic “food wrap” around the adhesive surface of the trap to cover the sticky surface. This will make a ‘sandwich’ of mosquitoes between the sticky plastic and the plastic “food wrap” and means the sticky plastic can be handled.
2. The sheet can now be cut away from the trap using a disposable scalpel.
3. Mosquitoes in the sheet can be identified morphologically by holding the transparent plastic sheets against plain white paper and using a torch for extra light if necessary
4. For further study (e.g., molecular assays or storage for later visual identification), individual mosquitoes can be removed by cutting through the layers of plastic around the sample with a scalpel and the plastic disc placed in two or three drops of non-toxic Mobe-Moat solvent. Hold the plastic sandwich in place with a blunt needle and use soft forceps to pull off the plastic wrap and remove the sample. The sample can then be stored in a tube with silica gel for subsequent analysis.