Standard Operating Procedure for the Furvela tent trap for sampling host-seeking mosquitoes

Effective Date: 19 November 2021

SOP #: FTT-2021

Image: Charlwood et al. Peer J.

PacMOSSI
Pacific Mosquito Surveillance Strengthening for Impact

Scope

The purpose of this SOP is to outline the materials and processes required to deploy Furvela tent traps to collect host-seeking adult mosquitoes.

Overview

Description: The Furvela tent trap was developed by Derek Charlwood and utilises a human bait to attract mosquitoes, which are then trapped as they attempt to host-seek (Charlwood et al. 2021). The main components are the tent that is used to protect the sleeping person, and the CDC light trap that traps the mosquitoes at the entry to the tent. Specifically, the Furvela tent trap samples mosquitoes that are seeking a human blood-meal while outdoors.

Target species and physiological states: Captures host-seeking females of many species.

Entomological surveillance indicators: Adult vector occurrence, density and biting location. The ratio of indoor to outdoor host-seeking can be estimated by simultaneously sampling with the Furvela tent trap outdoors and a CDC light trap beside a protected person indoors.

Advantage: This method uses cheap, readily available materials and can be easily constructed. The human host is protected from mosquito bites by the tent.

Disadvantage: This method is labour intensive, requiring one person to sleep in each tent to act as the bait.

Sampling period: The Furvela tent trap is usually deployed overnight for 12 h periods.

Data: Total number of host-seeking females per sampling effort (by species). When necessary, field data is merged with the results of subsequent laboratory analyses.

Materials

- ◯ Tent
- ◯ CDC miniature light trap (model 512)
- ◯ Wire (2 pieces 7 cm long, 1 mm diameter)
- ◯ 6 V rechargeable battery (≥4.5 Ah)
- ◯ Camping mat
- ◯ Ground sheet for tent
- ◯ Consent forms
- ◯ Pen/pencils/markers
- ◯ Labels
- ◯ 2 x medium bulldog or binder clips
- ◯ Needle and thread
- ◯ Battery charger
- ◯ Sleeping bag
- ◯ Data collection forms/digital device
- ◯ Head torch
- ◯ Oral aspirator
- ◯ Forceps
- ◯ Microcentrifuge tubes

Product description

The basic concept of the Furvela trap is that the mosquitoes are attracted to a small opening on the side of the tent. When they approach the opening they are sucked into a CDC trap suspended near this small opening (Figure 1).

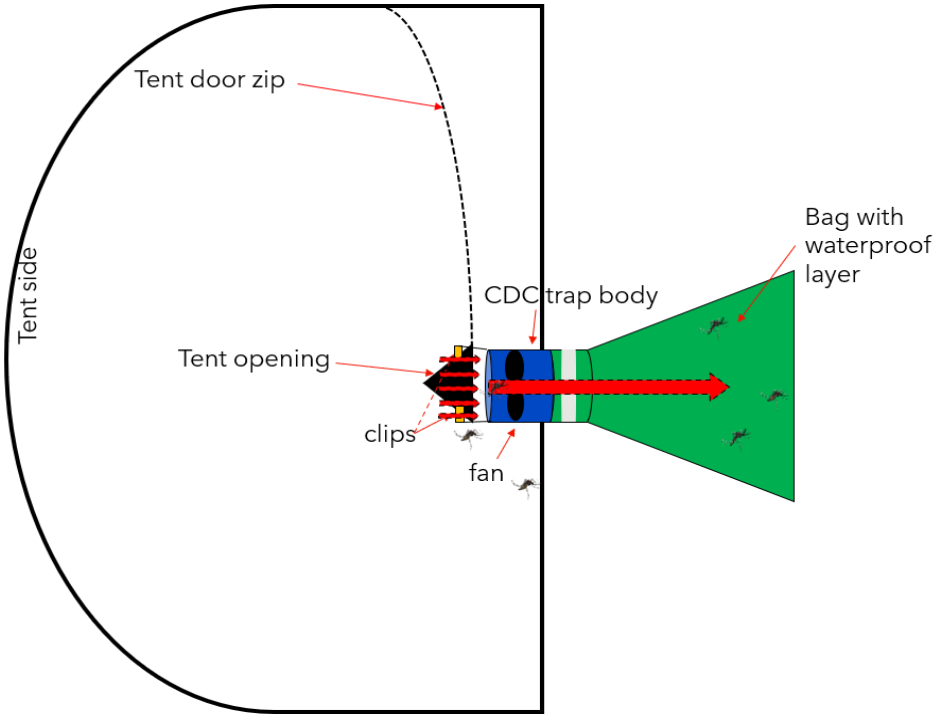


Figure 1. The basic concept of the Furvela trap with the mosquito flight path indicated by red arrows. Mosquitoes drawn by Dr Ana Ramirez.

Furvela tent-traps can be constructed using any commercial tent that has at least one door for access, which can remain without coverage from the external tent cover (flysheet) after construction (i.e. the flysheet may be pinned back to expose the door). If the trap is being operated in pouring rain then consider closing the flysheet. Tents like these weigh only a few kilos and so can easily be backpacked to remote areas for mosquito collection if required. Examples of tents that can be used are:

- Single-door tents that have been used include: Arenas 2 from Quecha (Decathlon www.decathlon.co.uk £20 (€28 or $32)), Camp Dome 200 and 400 from Campmaster www.campmaster.co.za: the Vaude Ultra light 2 www.vaude.com and the Hoolie Wildcountry 2.
- Double door tents that have been used include the Glen Orchy Highlander2 evaq8.co.uk, the Quecha 2 door for £48 (€68 or $75) www.decathlon.co.uk and the Nemo Losi 3 person tent www.nemoequipment.com
- A footprint/ground sheet for the tent. This can be purchased from the tent supplier but a piece of plastic sheet works as well.

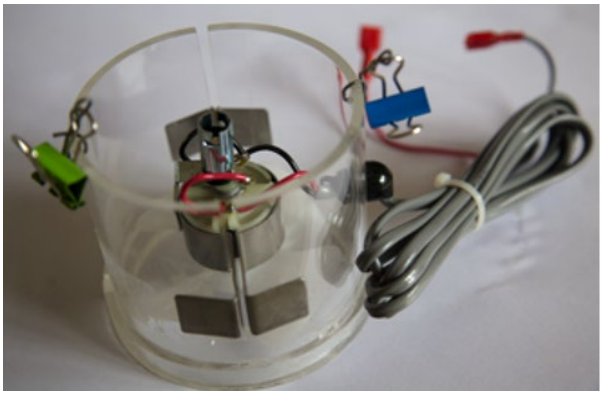
Initial construction

1. **Sew the end of the zip back onto itself to keep the door of the tent open at one end of the zip. The opening should be approximately the same size as the diameter of a CDC light-trap.**

Image: Charlwood et al. Peer J.

2. **Remove, the lid, light and grate from a standard CDC miniature light-trap. Make two holes, approximately 2 mm in diameter close to the top of the Perspex of the trap. Holes can be made either with a hot wire or a small drill. Wire can easily be used to make the holes in the Perspex. Simply heat the wire until it is red hot in a flame (from, say, a gas cooker) and immediately, gently push the wire through the Perspex to make the hole.**

3. **Pass a piece of wire through each hole and attach to one handle of a medium 'bulldog' clip.**
    a. The wire should be stiff, but malleable, and 1 mm in diameter (or 16 – 18 gauge wire) and cut to a length of ~7 cm.



4. **Sew two eyelets (the orange ribbon structures) at each side of the bottom of the collection bag. These eyelets will be used as fittings to tie the trap base to guy lines and thereby suspend it above the ground (see front page figure or step 3 figure in initial trap set-up instructions below).**

5. **Sew a waterproof cover on to the top half of the bag**

Trap location selection

1. The site where the human-baited tent trap will be deployed must have enough flat open ground space to set up the mesh tent and to walk around the tent before, during and after mosquito collections.

2. Select a spot with low vegetation which is at least 0.5 meter longer and wider than the mesh tent; for the advised tent size that means an open space of at least 2.5 meters long and 3.5 meters wide.

3. Whenever possible, avoid clearing vegetation to set up the tent.

4. The location of sampling is always negotiated with the owner of the property. Ensure that the owner is happy with the location of where sampling will be conducted.

Sampling procedure

1. **The tent**
   a. The tent groundsheet should extend at least 60 cm in front of the tent door. This makes both entering and leaving the tent more comfortable and also reduces the likelihood that ants or other predators might find their way into the CDC trap.
   b. Some tents already come with guy ropes in front of the door. If they do not, two ropes need to be attached so that the CDC trap can be suspended at the tent entrance. This is generally not a major difficulty.

2. **Installation:**
   a. Pass the CDC power cables through the opening of the tent, so that the occupant of the tent (the bait) can attach the battery to the trap once they are inside the tent.
   b. Attach the body of the CDC trap to the opening of the tent using the bulldog clips so that it is suspended horizontally, about 3 cm in front of the opening of the tent door.
   c. Note that when functioning, the CDC trap will draw in any mosquitoes flying between it and the tent hole so mosquitoes will not enter the tent, but it is important to not have the CDC trap body more than 3 cm so that proper suction is maintained to draw in mosquitoes.

Image: Charlwood et al. Peer J.

3. **Attach the collection bag to the trap and to the guy ropes in front of the door.**
   a. A string is threaded through the eyelets and attached to the guy ropes in front of the door, using a simple over and under knot like the 'cow hitch' to prevent the bag sliding down the rope (www.netknots.com).

4. **Adjust the tension on the guy ropes to keep the trap in a horizontal position.**
    a. The string can also be attached to a separate pole.
    b. The only way in which predators or scavengers (such as ants) can enter the trap are via the two clips that attach the trap to the tent, or the string that is used to attach the bag to the guy ropes.

5. **The human bait should enter the tent at the start of the sampling period.**
    a. The collector enters in the tent trap with sleeping mat, sleeping bag and the battery for the trap at sunset.
    b. The collector sleeps with their head near the trap opening (as the sleeping bag prevents human odours escaping near the feet).
    c. A single person should sleep in each tent.

6. **Place the rechargeable battery inside the tent near the opening and connect the power cables.**
    a. As DC motors reverse their direction of rotation with voltage polarity changes, care needs to be taken that the red (+) battery lead is attached to the positive terminal of the battery and the black (-) lead is attached to the negative terminal of the battery.

7. **To service the trap:**
    a. Exit the tent.
    b. Place one hand around the trap bag so that mosquitoes cannot escape and undo the drawstring with the other hand.

c. Continue to pull the drawstring closed then loop and tie it around the end of the bag to be confident that the drawstring will not become loose.

d. Lastly, disconnect the battery from the trap.

8. **Temporarily store the mosquitoes in labelled catch bags until processing and long-term storage. For further details see** SOP# MOS-2021.

Additional notes:

- Charge the battery after a single night's use to avoid complete discharge since the trap does not use a light the energy requirements are only approximately half those of a CDC light-trap (170 mAmp/hr compared to 320 mAmps/hr for the trap with a bulb). Thus, a 6V 4.5 Ah battery, weighing just 400 grams can power the trap for around 14 hours.

- When not used as a tent-trap the CDC trap can easily be reconverted to the standard light-trap without the need to remove the clips since they hang outside of the trap body. The tent can also, of course, be used as a normal tent.

- Check the speed of the fan and intensity of the light for any problems.

- The exact time for the host to enters and exits the trap depends on work-plan. For anophelines and other night biting mosquitoes, the time to enter the trap is shortly after, or at, sunset.

- The collection bag can be used for the entire sample period (usually overnight), or can be changed at regular intervals throughout the sampling period.

Videos

To watch videos on how to assemble and deploy the Furvela tent trap go to:

- The MOZDAN Furvela tent-trap - https://www.youtube.com/watch?v=oSoo8Z9c0W0&t=200s
- Ultimate Furvela tent-trap - https://www.youtube.com/watch?v=irgBPrDQ2Pw
- Furvela tent-trap 2 - https://www.youtube.com/watch?v=3UCOhfPGgiw

Human ethics

Where human ethics approval is required and granted, village residents will be recruited following standard informed consent procedures. The potential risks and benefits of mosquito sampling will be discussed verbally in the local language with the aid of a participant information sheet detailing these issues in writing.

For further details on human ethics see SOP# MOS-2021.

Safety/Risk assessment

Your workplace may require you to complete a risk assessment prior to conducting field work. There are a range of risks to which field workers could be exposed, and when sampling with Furvela tent traps may include:

- Mosquito transmitted infections
- Chloroform
- Dog bites
- Battery hazards
- There is a small risk that you may burn yourself when heating the wire. If so, then immediately remove your hands from the source of heat, apply first aid and seek medical advice if required.

For further details on safety and risk assessments see SOP# MOS-2021.

References

Charlwood, J. D., Rowland, M., Protopopoff, N., & Le Clair, C. (2017). 'The Furvela tent-trap Mk 1.1 for the collection of outdoor biting mosquitoes.' *PeerJ Life & Environment.* https://doi.org/10.7717/peerj.3848

Hocks, J.H. (accessed 2021) 'CDC Miniature light trap – model 512: Instructions.' https://www.johnwhock.com/wp-content/uploads/2012/10/instr_512_CDCMiniature.pdf

Sudia WD, Chamberlain RW. (1962) Battery-operated light trap, an improved model. *Mosquito News*. https://www.biodiversitylibrary.org/content/part/JAMCA/MN_V22_N2_P126-129.pdf

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Suggested citation

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