

Traps and Collection Methods for *Aedes aegypti* and *Aedes albopictus* Surveillance and Control June 2017

BG-Sentinel trap

- **DESCRIPTION:** The BioGents (BG) -Sentinel trap is a lightweight pop-up cylinder with an opening on its top surface. A funnel is fitted into the opening and a small electric fan pulls mosquitoes into a collection bag. Traps are usually equipped with odorant lures available from BioGents. CO₂ can be used in conjunction with or as an alternative to BG lures. Newer versions of the trap feature a weighted flap that closes to prevent mosquitoes escaping if the fan fails.
- **TARGET:** Primarily *Aedes aegypti* and *Aedes albopictus*, however other species are also attracted to the trap. Target species will change depending on attractants used, and CO₂ will broaden the diversity of the mosquito collection.
- **PROS:** Sensitive for human-seeking mosquitoes, especially *Aedes* spp.¹⁻³; high portability; low visibility; specimens do not pass through a fan and are often in better condition than CO₂-baited trap collections.
- **CONS:** Requires battery maintenance or connection to power outlet; may need frequent collection depending on power source; predators and ants may damage or remove specimens; may need shelter to prevent rain damage; some evidence suggests that certain populations of *Aedes aegypti* may be repelled by 1-octen-3-ol bait⁴.



Airflow through a BG-Sentinel trap. Mosquitoes are forced in with air intake (yellow arrows) while odorant lure is simultaneously dispersed by air outflow (red arrows).

Source: http://www.bg-sentinel.com/en/mosquito_monitoring.html

Gravid Ovitrap (BG-GAT, CDC-AGO, Springstar Trap-N-Kill)

- **DESCRIPTION:** Gravid traps take advantage of female mosquito oviposition behavior. Unlike gravid traps targeting *Culex* species, *Aedes* gravid traps are enclosed containers of water (sometimes with an attractant infusion) that mimic typical artificial container oviposition sites. Once female mosquitoes enter a trap, they encounter a killing agent and/or an adhesive. Most traps also include a barrier to prevent trapped females from dropping eggs into the water. The CDC's Autocidal Gravid Ovitrap (AGO) is lined with adhesive paper on its inner surface; BioGents-Gravid *Aedes* Trap (BG-GAT) can be treated on its inner surface with insecticide⁵ or oil; and SpringStar's Trap-N-Kill contains an insecticide-treated (Dichlorvos) velour strip.
- **TARGET:** Gravid female mosquitoes; *Aedes aegypti* and *Aedes albopictus*.
- **PROS:** Target-specific for container-breeding *Aedes*; low maintenance: collection intervals can be extended to one week or more; high density trap deployment can be used for population reduction⁶; CDC-AGO sensitivity for *Aedes aegypti* has been shown to be comparable to that of BG-Sentinel traps in one California study⁷.
- **CONS:** May capture high numbers of non-target insects, especially when used with attractant infusion; humidity or dust can reduce lifespan of adhesive paper; specimens can be difficult to remove from adhesive and often sustain damage, making identification or testing more difficult; molecular assays on specimens may be inhibited by adhesive contamination; traps may support larval development if not inspected regularly; larger traps (e.g., AGO) are highly visible and water infusions may smell offensive to residents.



CDC Autocidal Gravid Ovitrap⁸

In2Care trap

- **DESCRIPTION:** The In2Care trap takes advantage of female mosquito oviposition behavior to disseminate larvicides to cryptic breeding sites. In2Care traps consist of a container of water with an inner floating structure that allows females to rest and oviposit. This structure carries gauze impregnated with pyriproxyfen, a juvenile hormone analogue that prevents larval development, and spores of *Beauveria bassiana*, a fungus that kills adult mosquitoes within a few days of exposure. Females pick up both agents on their bodies when they land in the trap, and carry pyriproxyfen to other containers as they continue to oviposit, preventing larval development in these containers as well. Over a few days, *B. bassiana* spores on contaminated females will germinate and kill the mosquito.
- **TARGET:** Gravid female mosquitoes; *Aedes aegypti* and *Aedes albopictus*.
- **PROS:** Target-specific for container-breeding *Aedes*; auto-dissemination of larvicides to cryptic sources for population reduction; elimination of blood-fed females that may be harboring viruses.
- **CONS:** Unlike traditional traps, the In2Care trap kills developing larvae and allows adult females to escape, requiring additional collection methods to monitor mosquito population reduction; currently only provisionally licensed by the US EPA for areas with local Zika transmission, so not to be used elsewhere. If not maintained regularly, traps may support larval development as pyriproxyfen efficacy wanes.



Mode of mosquito population reduction by [In2Care trap](http://www.in2care.org/products/trap-workings/).
Source: <http://www.in2care.org/products/trap-workings/>

Ovicup trap

- **DESCRIPTION:** Ovicups target container-breeding *Aedes* mosquitoes. Construction materials vary and need only provide (1) a small, dark colored or opaque container of undisturbed water and (2) an oviposition substrate (e.g., strip of paper or wood) along the water margin. It is best if the container material is non-porous and smooth, as this may help limit oviposition to only the removable substrate. The container need only be approximately half-full of water; this provides a partially shaded and protected oviposition site. For best results, the oviposition substrate should line the entire exposed surface of the container walls and should also extend below the water margin to account for evaporation. Trial and error may be necessary to determine best materials for construction, and whether additional stabilization is required to prevent the ovicup from tipping.
- **TARGET:** Gravid female mosquitoes; *Aedes aegypti* and *Aedes albopictus*.
- **PROS:** Sensitive and specific for container-breeding *Aedes* spp.; inexpensive and simple to make.
- **CONS:** Low populations of mosquitoes and/or high availability of alternative oviposition sites may reduce trap sensitivity and egg abundance; ovicup water level requires frequent collection and maintenance, especially in dry and hot areas or after rain; eggs must be reared to larval or adult stages for identification, or tested at UC Davis Arbovirus Research and Training laboratory to determine species; ovicups can become mosquito sources if not inspected regularly.



Typical ovicup trap, Fresno MVCD. Here a dark plastic cup is set on the ground with a strip of absorbent paper secured with a paper clip to completely line the exposed surface of the cup. Windy areas may benefit from weighted cups or from attaching a stake to anchor each cup.

Aspirator collections

- **DESCRIPTION:** Mechanical aspirators consist of a tube or funnel attached to a fan that forces mosquitoes into a collection bag or container. Vegetation aspiration can yield a wide range of species, whereas backpack or handheld aspirator collections can be targeted to capture *Anopheles* or *Aedes* mosquitoes from resting surfaces or upon host-seeking and landing during property inspections.
- **TARGET:** Resting adult mosquitoes, host-seeking and landing *Aedes aegypti* and *Aedes albopictus*.
- **PROS:** Captures both females and males, range of physiological states, and a wide range of species; efficient collection method for blood-fed mosquitoes; specimens remain in good condition.
- **CONS:** Prolonged aspiration collection often requires multiple batteries; apparatus can be heavy to operate; labor intensive; may capture high numbers of non-target arthropods.



[Modified CDC backpack aspirator.](http://johnwhock.com/products/aspirators/modified-cdc-backpack-aspirator/)

Source:

[http://johnwhock.com/products/aspirators/
modified-cdc-backpack-aspirator/](http://johnwhock.com/products/aspirators/modified-cdc-backpack-aspirator/)

CO₂-baited traps (CDC, Encephalitis Vector Surveillance)

- **DESCRIPTION:** CDC and encephalitis vector surveillance (EVS) traps are typically used for collection of *Culex* spp. mosquitoes for arbovirus surveillance; however, these traps are sometimes effective for collection of *Aedes aegypti* and *Aedes albopictus*. Carbon dioxide (CO₂)-baited traps such as CDC and EVS traps are suspended from a tree or other vertical structure, and CO₂ is supplied typically by a cooler of dry ice that releases CO₂ above or in the general proximity to the trap; coolers with spouts can be aimed directly at the trap. A small electric fan forces mosquitoes into a collection net or container.

Variations include using CO₂ provided by gas cylinders or by yeast fermentation vats; however, gas cylinders are prone to theft, and yeast fermentation often produces inconsistent rates of CO₂. Non-target insects or other species may also be attracted to yeast fermentation mixtures. These traps can be used with or without a light as an additional attractant. A BG lure may also be used with the CO₂ trap to enhance attractiveness for *Aedes* mosquitoes.

- **TARGET:** Host-seeking adult female mosquitoes
- **PROS:** Broad range of target species; trap height can be adjusted for different species.
- **CONS:** May exhibit collection bias related to host-seeking differences in local vector ecology; requires battery and CO₂ replacement; specimens may be damaged as they pass through the fan; may capture large numbers of non-target insects especially if using lights; not attractive to blood-fed females.



[CDC trap as set by Fairfax County Health Department, VA.](http://www.fairfaxcounty.gov/hd/westnile/wnvtraps.htm)

A protective sleeve has been added to prevent rain damage to specimens in netting and collection cup.

Source:

<http://www.fairfaxcounty.gov/hd/westnile/wnvtraps.htm>

CITED REFERENCES

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GENERAL RESOURCES

See Appendix A of "[California Mosquito-borne Virus Surveillance & Response Plan](#)" (http://westnile.ca.gov/downloads.php?download_id=3744&filename=2017%20CA%20Response%20Plan.pdf)

[CDC guidelines for *Aedes* surveillance and Insecticide Resistance Testing](https://www.cdc.gov/zika/pdfs/guidelines-for-aedes-surveillance-and-insecticide-resistance-testing.pdf) (<https://www.cdc.gov/zika/pdfs/guidelines-for-aedes-surveillance-and-insecticide-resistance-testing.pdf>)

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