COMPARISON OF THE CDC LIGHT TRAP AND THE DYNATRAP® DT2000 FOR COLLECTION OF MOSQUITOES IN SEMI-FIELD AND FIELD SETTINGS

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ABSTRACT

The CDC light trap has been the standard used by mosquito control programs to conduct mosquito and arbovirus surveillance. For the last two decades, this trap has been used with little to no modifications to its original design. Recently, new traps that utilize different light sources, modified designs, and attractants have been developed and evaluated against the CDC light trap. A semi-field and field comparison of the Dynatrap® (Model DT2000) against the CDC light trap was conducted at Anastasia Mosquito Control District. The DT2000 varies from the CDC light trap with a UV light, trapdoor/fan mechanism, and Atrakta lure which is a combination of lactic acid, ammonia, and hexanoic acid. Overall, the DT2000 collected 56% (327/600) of the *Ae. aegypti* released in the semi-field cage, compared to 18.5% (111/600) collected by the CDC light traps. These findings suggest that the DT2000 outperformed the CDC light trap in collecting *Ae. aegypti*. In the field, the DT2000 collected nine target mosquito species while the CDC light trap collected four target species. The DT2000 averaged 109 ± 97.46 mosquitoes and the CDC light trap averaged 8 ± 4.64 mosquitoes. The DT2000 presented functional limitations in the field as an electrical outlet was required. Study findings suggest that where an electrical outlet is available, the DT2000 may be an alternative to the CDC light trap for mosquito surveillance.

Key Words: mosquito surveillance, CDC light trap, mosquito traps, *Aedes aegypti*

For decades, mechanical traps have served as one of the primary means by which mosquito surveillance is conducted (Kline, 2006). Additionally, these traps have provided many useful ways to survey blood-feeding vectors in the genera *Aedes*, *Anopheles*, and *Culex*. These mosquito genera are vectors of important diseases such as West Nile virus, malaria, yellow fever, and Zika virus (Turell, 2001).

To monitor these vector species, the CDC light trap has been used for years with little to no modifications to its original design. This design as shown in Figure 1A includes a black circular plastic piece that covers a cylindrical clear plastic housing unit, which holds a standard incandescent bulb, a wire mesh, and a small computer fan with motor. A funnel attaches to the housing unit which has threading at the end for attachment of a capture bottle. This CDC light trap is powered by a 12-volt battery. As a shift from this original CDC light trap design, Dynatrap® (Dynamic Solutions Worldwide, Milwaukee, WI) has produced the DT2000 (Figure 1B). This trap comes with components that distinguish it from the CDC light trap, which include a UV light, trapdoor/fan mechanism, and Atrakta® lure (Dynamic Solution Worldwide LLC, Milwaukee, WI), a combination of lactic acid, ammonia, and hexanoic acid. Though the DT2000 is intended for homeowner use, this trap may have a potential role in operational mosquito surveillance. Therefore, Anastasia Mosquito Control District (AMCD) of St. Johns County, FL conducted a semi-field and field evaluation of the DT2000 in comparison with CDC light trap.

A study was carried out in a semi-field setting to compare the Dynatrap® DT2000 with the CDC light trap. The study was conducted in two 6m x 12m screened enclosures located on the AMCD complex. The DT2000 was hung in one screened enclosure and the CDC light trap was hung in the second screened enclosure. Both traps were hung at 0.9m from the ground by a

Figure 1. A) The CDC light trap and B) the DT2000 trap displayed in the semi-field cages during the initial comparison on recapture rate of *Aedes aegypti*.

shepherd's hook. The DT2000 was powered using an outdoor outlet and the CDC light trap was powered by a 12-volt battery. The traps were both baited with the Atrakta® lure. Two hundred 5-7-day old female *Ae. aegypti* were aspirated into transport cages and released in two screened enclosures by placing and opening transport cages at a distance of 7m from the traps. The containers for each trap were removed at 24 hours from initial release, the collection bags were placed in a freezer, and then the mosquitoes were counted to determine the number of *Ae. aegypti* recaptured. Three replications were conducted. A Student's t-test was used for the comparison of the collections from two traps.

Overall, the DT2000 collected 56% (327/600) of the *Ae. aegypti* released in the semi-field cage, compared to 18.5% (111/600) collected by the CDC light trap. These findings suggest that the DT2000 outperformed the CDC light trap in collecting *Ae. aegypti* (t=3.812, df=4, P=0.0189). After the successful evaluation in the semi-field cages showing difference in performance of the two traps, a field evaluation was conducted.

Field evaluations were conducted to compare the traps in terms of mosquito abundance and diversity. The design of the field test was similar to the semi-field test with these traps placed one at each study site and rotated twice for a total of three replications. The two areas chosen had power outlets, however to maximize suitable mosquito trapping habitat, several extension cords were used for the trap to function at the selected field sites. The traps were operated for 24 hours and collections were brought back to AMCD and stored in the freezer until the samples were processed. Mosquitoes were counted and speciated. All non-target arthropods were identified to order. A Student's t-test was used for the comparison between the collections by two traps.

Originally, the field testing of the DT2000 was to be conducted in a swampy forested area in St. Augustine, FL. However, several limitations quickly arose. To allow the DT2000 to operate without a power outlet, a wire power converter was hooked up to a 12V car battery. Upon returning the following day, the battery was drained. During the following weeks, several attempts were made to enable the DT2000 to work without a power outlet. These attempts included switching wire configurations, adding an additional car battery, and also trying deep-cycle batteries in place of car batteries (Figure 2).

Unfortunately, the battery modification outcomes were the same. After monitoring the power output of the DT2000 every hour, it was found that the power of the deep-cycle batteries would begin to waiver at about 4 hours and would be depleted by 5 hours. Following the continued battery failures, it was determined that the DT2000 required

Figure 2. The picture demonstrates the attempts to utilize a battery with the DT2000 to allow for placement and evaluation in field settings.

a power outlet for field use. The two areas chosen had power outlets, however to maximize suitable mosquito trapping habitat, several extension cords were used for the trap to function at the selected field sites.

Table 1 shows the total number by species collected by two traps in the field evaluation and the numbers were not different from each other (t=1.0, df=16, P=0.3129). Overall, the DT2000 collected nine target mosquito species while the CDC light trap collected four target species. The collections with the DT2000 averaged 109 ± 97.46 mosquitoes (n=3 trap nights) and the CDC light trap averaged 8 ± 4.64 mosquitoes (n=3 trap nights). *Anopheles crucians* was the outlier with an average of 99 ± 81.8 collected per trap night for the DT2000 and 5 ± 2.3 for the CDC light trap. For all other species, the DT2000 averaged 11 ± 3.4 mosquitoes per trap night with the CDC light trap averaging 3 ± 1. These numbers are very low for mosquito trap evaluations and suggest that further evaluations of the DT2000 trap is necessary in a more productive mosquito location.

Table 2 shows the total numbers of three non-target orders in the CDC light traps, compared to the four non-target orders captured in the DT2000. The DT2000 had significantly higher non-target collection than CDC light trap (t=1.3738, df=6, P=0.2186). The number of Lepidoptera specimens collected in the DT2000 compared to the CDC light trap warrants further investigation to figure out whether this trap is a suitable tool for mosquito surveillance due to the impact on non-targets. Replacing the attractant used with the DT2000 with octenol may reduce the number of non-targets collected.

Dynatrap® recently marketed a new DT160 trap which may have potential in mosquito surveillance. Though smaller and slightly different than the DT2000, the DT160 operates with a 12V battery which helps it surpass any power limitations. The price of one of these traps is around $50 which is less expensive than the CDC light trap. For resource limited mosquito control programs, these traps could be used as a tool for surveillance to better direct control in the field and thus should be investigated further.

Table 1. Total number of mosquito species collected by the DT2000 and CDC Light Traps.

Species	DT2000	CDC
Aedes aegypti	1	0
Anopheles crucians	296	14
Culex erraticus	6	1
Culex salinaris	5	3
Culex quinquefasciatus	1	0
Culiseta melanura	16	5
Coquillettidia petrubans	1	0
Psorophora columbiae	1	0
Mansonia sp.	1	0
Totals	328	23

Table 2. Total number of non-targets by insect order collected by the DT2000 and CDC Light Traps.

Non-target Order	DT2000	CDC
Coleoptera	41	1
Diptera	73	17
Mecoptera	8	0
Lepidoptera	340	25
Totals	462	43

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