

AEDES ALBOPICTUS EGG COLLECTIONS – 2021

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ABSTRACT

Aedes albopictus, referred to as the Asian tiger mosquito or ATM, is a vector of many arboviruses including the Zika virus. Originating in Asia, ATM has quickly become an invasive species on other continents. The Central Massachusetts Mosquito Control Project monitors for the presence of the Asian tiger mosquito in member communities by setting specialized devices called ovitraps that this species of mosquito finds an appealing place to lay their eggs.

OBJECTIVE

Aedes albopictus mosquitoes are native to areas that have warm, tropical climates. Indigenous to Asia, it is believed that they have traveled throughout the world as dormant eggs in used tires or imported plants such as the Lucky Bamboo plant (*Dracaena sanderana*)¹. Over time, they have evolved to survive in areas that have cooler and drier climates. They can now be found on every continent with the exception of Antarctica². The *Aedes* mosquitoes lay their eggs just above the water line in artificial containers such as old tires, birdbaths, flower pots and tarps that have collected water. However, the amount of water it takes to fill a water bottle cap is an adequate environment for *Aedes albopictus* to lay eggs. The eggs desiccate and can remain for years before they are rehydrated and the mosquito life cycle continues.

Beginning in 2016, the Central Massachusetts Mosquito Control Project

(CMMCP) began conducting surveillance to determine if the *Aedes albopictus* mosquito has made its way into our member communities. CMMCP uses gravid traps and CDC traps to catch adult mosquitoes. However, the *Aedes albopictus* mosquitoes are not attracted to either of these mosquito traps. Research suggests the mosquitoes are attracted to the ovitrap because it provides them a supply of clean water to lay their eggs. The use of ovitraps helps to determine if the *Aedes albopictus* mosquito has made its way into the Central Mass Mosquito Control Project service area.

Adult male *Aedes albopictus* specimens feed on nectar and do not blood feed. Adult female *Aedes albopictus* mosquitoes are persistent and painful day time biters who need to take a blood meal in order to lay their eggs. Frequently, they are not able to take a full blood meal from a single host. Although they prefer human blood, they are opportunistic feeders and will feed on

other mammals and birds. This makes them very effective vectors of disease³.

MATERIALS AND METHODS

Ovitrap provide an artificial habitat for mosquitoes that prefer to lay their eggs in containers. The trap consists of a 5.5 inch (13.5 centimeter) black plastic cup. Holes are drilled into the cup 1.5 inches (3.8 centimeters) from the top to prevent

the cups from overflowing during rainfall. The cups hold roughly 11 ounces (310 milliliters) of clean water, dependent on where the holes are drilled. Oviposition paper lines the inside of the cup. The paper has a rough, textured surface which allows the eggs to adhere to the paper. The cup is then filled to the holes with tap water that has been left to allow chlorine in the water to dissipate (Figure 1).



Figure 1

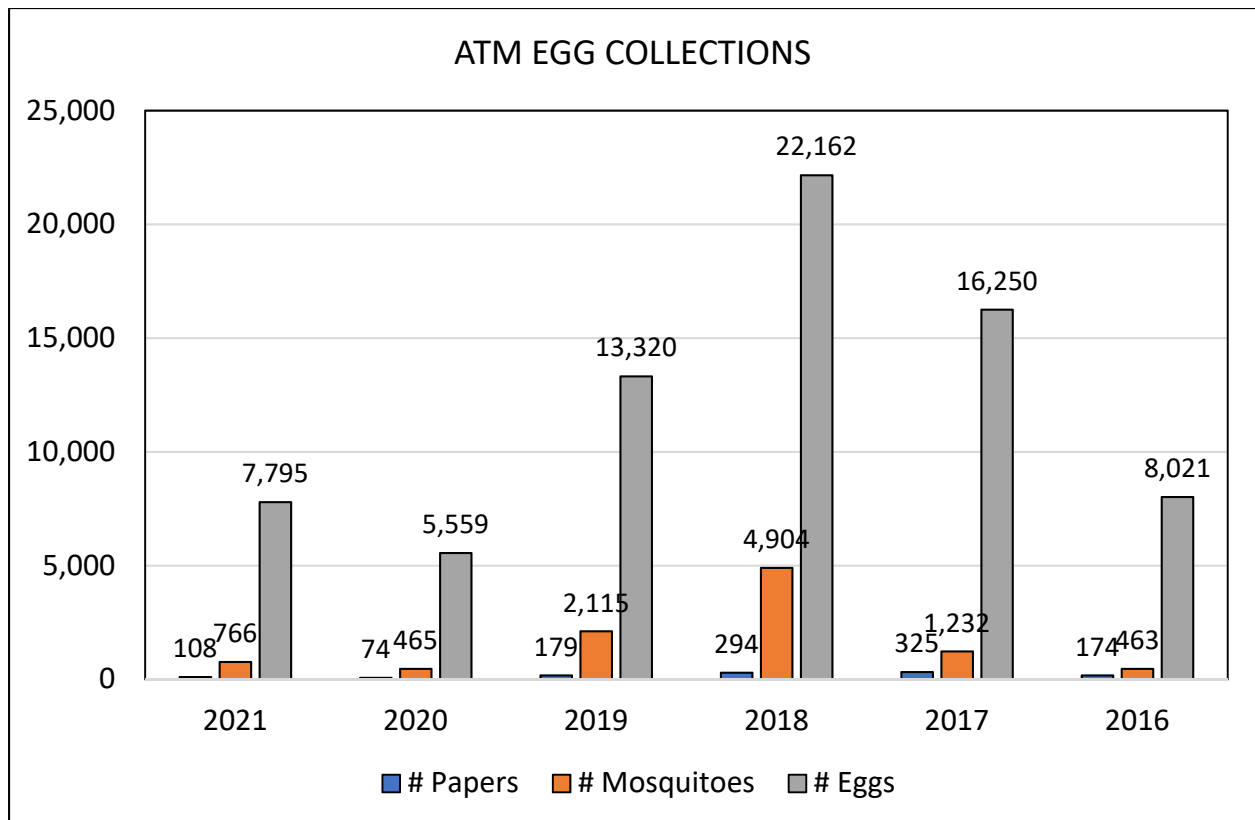
If a female *Aedes* mosquito finds the cup and is ready to lay eggs, it will lay them just above the water line. Five traps are left at each trap site and remain at that location for fourteen days. Traps are set in areas where *Aedes albopictus* mosquitoes are likely to be found. The small water requirement and their preference for human blood meals make urban areas a likely habitat for *Aedes albopictus* mosquitoes. Upon retrieval of the ovitraps, the papers are air dried. Once desiccated, the papers are examined under microscope for the presence of mosquito eggs. If there are

mosquito eggs, they are counted before being transported to the Massachusetts Department of Public Health (MDPH). In an insectary at the MDPH, the papers are rehydrated. If the eggs hatch and the mosquitoes continue their life cycle, they are identified to species. Rearing the mosquitoes in an insectary will prevent the release of individuals into the ecosystem. If *Aedes albopictus* are identified the our *Aedes albopictus* protocols are initiated (see Appendix A).

RESULTS

Since 2016, CMMCP has worked diligently to increase the number of trap sites as well as the number of traps that are placed. The graph below shows the number of mosquito papers that have been submitted to the Massachusetts Department of Public Health for rearing. While there is an increase in the number of papers submitted from 2020, MDPH set a limit to the number of ovitrap papers they would accept. It should be noted that the numbers do not reflect the number of traps that were set out, only the number of papers that had eggs. The corresponding chart also shows the

number of eggs that were submitted to the Department of Public Health for rearing. The number of eggs found does not coincide with the number of papers submitted. There can be thousands of eggs found on a single paper and zero eggs on the next paper from the same trap site. Of those eggs that are submitted for rearing, only a small percentage continue their development to the larval stage and are able to be identified to genus and species. When that information is obtained, it is disseminated to the mosquito control projects for the appropriate control response(s).



Over the summer of 2021, CMMCP deployed over ninety sets of ovitraps to

identify the presence of *Aedes albopictus* mosquitoes in our 44-member

communities. On July 9th, the Massachusetts Department of Public Health notified us that one ovitrap paper was found in the city of Lowell that hatched one *Aedes albopictus*. The paper, which had 94 eggs attached, hatched 34% of the eggs. Those larvae were identified as 32 *Aedes triseriatus*, and 1 *Aedes albopictus*.

In response to this finding, the CMMCP ATM Protocol was initiated. This protocol calls for a series of steps to be followed in the event that *Ae. albopictus* mosquito eggs or adults are found in an area. Recommendations from the protocol were conveyed to the Lowell Board of Health.

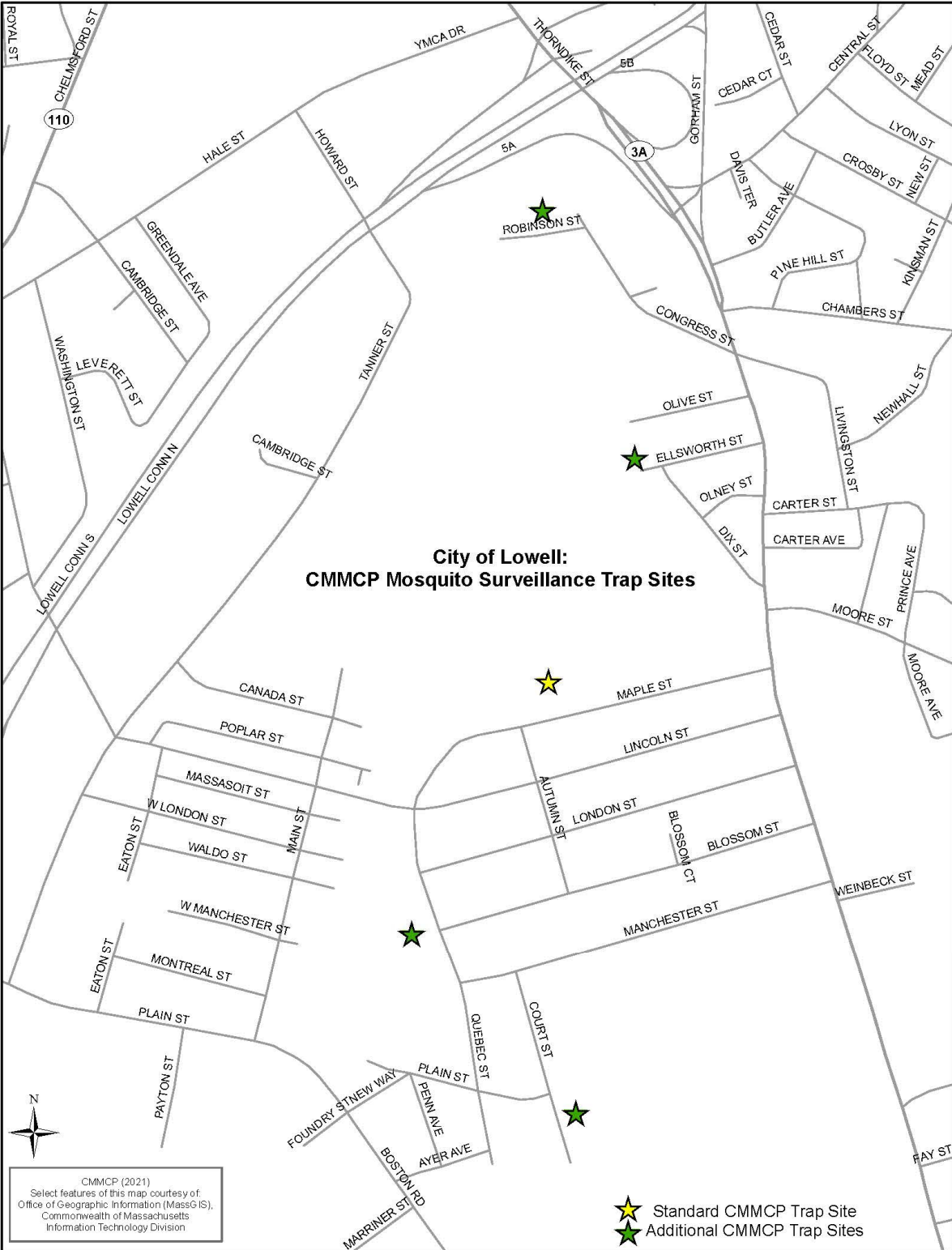


In the next step of the protocol additional trapping is recommended. CMMCP surveyed the area and located four

The first step in the protocol is to inspect for containers in a half mile perimeter from the trap site. Whenever possible the standing water was removed from the containers to eliminate the mosquito breeding sites. Bird baths, plastic buckets and wheelbarrows all have the ability to hold enough water for mosquito egg laying. If removal of the water was not an option, it was treated with an extended release larvicide which controls the mosquito early in their development before they can emerge as an adult. Some examples of containers where the water can be held and not be removed would be large tire piles, dumpsters, abandoned pools and concrete structures.



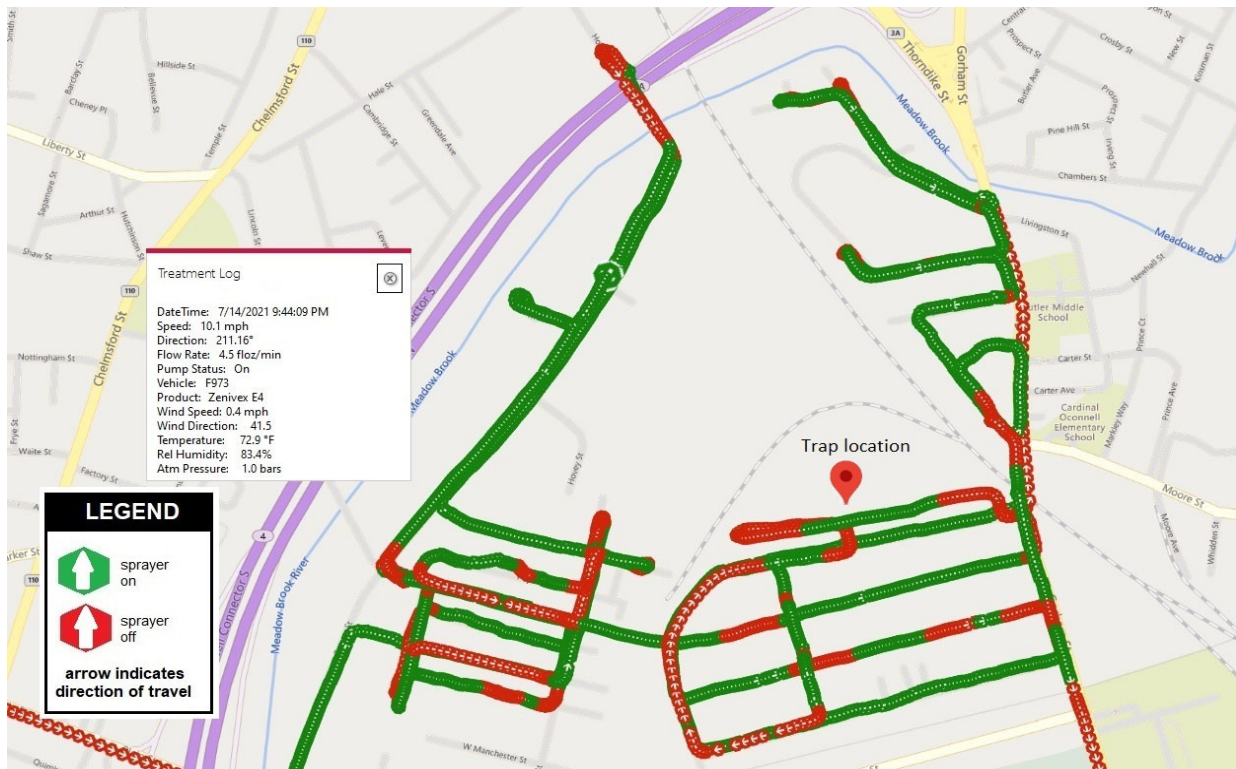
additional ovitrap sites were identified within a half mile radius of the site where the *Aedes albopictus* egg was found.



A recommendation to commence Ultra Low Volume (ULV) adulticide spraying in the area was presented to the Lowell Health Department. The adulticide was to be sprayed from truck-mounted machines after sunset. The adulticide CMMCP uses is called Zenivex® E4, active ingredient etofenprox. It is a low concentration (4%) solution applied at 10-15 mph at a low flow rate (4.5 oz./minute). Etofenprox is a reduced risk synthetic pyrethroid with an extremely low toxicity to mammals. This pesticide

presents a low toxicity to birds and dried foliar residues are not harmful to honeybees. After discussion with local health officials, notification is given to the Health Department that spraying would take place on the night of July 14th after sunset. A designated area was established from the collection point of the *Ae. albopictus* egg. All streets within the radius were sprayed. The map below shows the streets that were sprayed as well as the trap site location.

ULV spray map



Weather information gathered during the application from our ultrasonic weather stations mounted on each spray rig showed winds speed and temperatures conducive for this application.

CONCLUSION

Surveillance sites continued to be deployed throughout the summer and no other eggs were found. In addition to the ovitraps, BG Sentinel traps which attract adult *Aedes albopictus* mosquitoes were utilized at the trap sites. Surveillance of

these trap sites continued until the end of the mosquito trapping season and no adult *Aedes albopictus* were found. As the territory of the *Aedes albopictus* mosquito continues to expand, CMMCP will continue to increase the number of traps that we utilize, as well as the areas in which we place the traps. If found, CMMCP will continue to increase measures to help prevent further spread of the invasive species and the potential for it to vector mosquito-borne disease.

REFERENCES

¹ Qualls, W. A., Xue, R. D., Beier, J. C., & Müller, G. C. (2013). Survivorship of adult *Aedes ALBOPICTUS* (DIPTERA: Culicidae) feeding on indoor ornamental plants with no inflorescence. *Parasitology Research*, 112(6), 2313-2318. doi:10.1007/s00436-013-3396-1

² Westby, K. M., Adalsteinsson, S. A., Biro, E. G., Beckermann, A. J., & Medley, K. A. (2021). *Aedes albopictus* populations and Larval Habitat characteristics across the LANDSCAPE: Significant differences exist between urban and rural land use types. *Insects*, 12(3), 196. doi:10.3390/insects12030196

³ Faraji, A., Egizi, A., Fonseca, D. M., Unlu, I., Crepeau, T., Healy, S. P., & Gaugler, R. (2014). Comparative host feeding patterns of the Asian Tiger MOSQUITO, *Aedes ALBOPICTUS*, in urban and suburban Northeastern USA and implications for disease transmission. *PLoS Neglected Tropical Diseases*, 8(8). doi:10.1371/journal.pntd.0003037

Appendix A

Aedes albopictus (Asian Tiger Mosquito) control protocols

1.) Single identification:

- a) Coordinate with property owner(s) and discuss source reduction strategies
- b) Additional surveillance using best available products and methods
- c) Larval control using best available products and methods
- d) Adult control using best available products and methods
- e) Continue surveillance for minimum 2-4 weeks or until weather conditions deteriorate

Details:

- 1a: Survey area and check for containers, tires, etc. Offer advice and educational materials on basic mosquito biology and control in coordination with LBOH. Offer tire recycling services if appropriate.
- 1b: Supplement adult surveillance traps in area with different trap types to gauge overall species composition and population densities.
- 1c: Treat tire piles & other permanent water-holding containers with extended release larvicidal products; treat/empty smaller containers if possible. Recommend removal of water-holding containers to property owners.
- 1d: Set up autocidal gravid ovitraps or other ATM collection devices; ULV area as close to dusk as possible 1-2 times minimum in the first weeks following identification.
- 1e: Determine if *Ae. albopictus* presence continues.

2.) Multiple identifications:

- a) Coordinate with property owner(s) and discuss source reduction strategies
- b) Coordinate community outreach with LBOH's
- c) Additional surveillance using best available products and methods
- d) Weekly larval control using best available products and methods
- e) Multiple adult control applications using best available products and methods
- f) Continue surveillance until weather conditions deteriorate

Details:

- 2a: Re-survey area and check for containers, tires, etc. Aggressively market educational materials to area residents on basic mosquito biology and control in coordination with LBOH. Highlight tire recycling services to the public.

- 2b: Work with LBOH using social media, traditional media and Internet to education and inform public about *Ae. albopictus*.
- 2c: Continue supplementation of traps in area with different types to gauge overall species composition and population densities. Prioritize identification and virus testing from this area.
- 2d: Monitor and treat tire piles & other permanent water-holding containers as needed with extended release larvicidal products; treat/empty smaller containers if possible. Consider and prioritize removal of tire piles. Recommend removal of water-holding containers to property owners.
- 2e: Set up autocidal gravid ovitraps or other ATM collection devices; ULV area as close to dusk as possible 1-2 times in the first weeks following identification. Consider barrier treatments in area especially near container sites.
- 2f: Determine if *Ae. albopictus* presence continues until 2 consecutive hard frosts.
- 2g: Monitor location the following season