ASIAN TIGER MOSQUITO (ATM) SURVEILLANCE IN CENTRAL MASS. 2016

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INTRODUCTION

The Asian tiger mosquito, *Aedes (Stegomyia) albopictus*, is an introduced and invasive mosquito species in North America. Since its first introduction through the importation of used tires from Asia into Texas in 1985 [9, 16], it has spread across the United States. The Asian tiger mosquito (ATM) is now poised to enter New England within the near future [17]. The ability of this mosquito to use various small water habitats as breeding sites coupled with the expansion of its range through interstate trade and along highways [2, 7, 14] creates a new danger for the transmission of several vector-borne arboviruses to the citizens of Massachusetts. In light of these concerns, Central Massachusetts Mosquito Control Project (CMMCP) has decided to conduct regular ATM surveillance in our district. This presence/absence study will help us determine where introductions of ATM occur and help us prevent this invasive mosquito from gaining a foothold in Central Massachusetts.

<u>Habitat preference and ecology</u>:
The ATM is originally a tree-hole breeding mosquito found along forest edges in tropical and temperate Asia [1, 2, 16]. This mosquito has adapted its tree-hole oviposition reproductive strategy to the kinds of disposable small containers, cups, bottles and cans, tires, planter trays, trash cans and other small water bearing vessels that are found in peridomestic (around human habitation) areas in urban and suburban areas [1, 2, 5, 9]. These small containers tend to create optimal ATM larval habitat, when found in cool, shaded areas with presence of leaf litter [1]. There is also a noted correlation between increased human population and activities and increases in ATM populations [14]. Because of its unique behavior, ATM has been shown to be resistant to control using traditional vector control methods [11, 17].

ATM eggs have demonstrated desiccation resistance and have the ability to overwinter in climates similar to that of southern New England [1, 9, 13, 16]. Under predicted climate change scenarios for the region (i.e., increased average winter temperatures), it may be possible for ATM to be able to overwinter in Massachusetts within the next ten years [7, 11, 17]. Evidence from New Jersey suggests that ATM has a competitive advantage over other common Massachusetts tree-hole breeding mosquito species [1, 2, 16], and has been spreading from its introduction point in primarily urban and industrial habitats into the suburbs surrounding these areas [7].

Host preference:
Unlike the nighttime activities of more "ordinary" mosquito species, ATM has been shown to be an aggressive daytime feeder on mammals [2, 5, 12]. Laboratory evidence shows that when ATM is exposed to a range of mammals, it shows a preference for human scent[1, 2, 16], however, they are aggressive enough to feed on many animals from birds and reptiles to mammals [2, 13, 16]. This broad range of host preference has implicated ATM as a bridge vector, with the ability to transfer zoonotic disease from animal reservoirs to humans [1, 2, 5, 7, 10, 13, 16].

Arbovirus vector competence:
ATM has been determined to be a competent vector for West Nile virus (WNV) in both laboratory settings [14, 18] and in nature [1, 2, 7, 12, 18]. Its aggressive feeding behavior could allow ATM to become a bridge vector between bird virus reservoirs and human hosts [1, 2, 5, 7, 12, 13, 16].

ATM has also been determined to be a competent vector for Eastern Equine encephalitis (EEE) in laboratory settings [13, 14, 19]. It has the ability to become infected by EEE after biting birds [19], has been shown to have a longer survival period with the virus [13] and to have a higher viral transmission rate than similar species [19]. However, the transmission cycle for EEE is more complex and relies upon other species, consequently there is currently no evidence for direct transmission of EEE from ATM to humans [5].

ATM is a competent vector for all four Dengue fever (DENV) serotypes in laboratory settings [2, 14]. While DENV is not currently endemic to Massachusetts, it should be noted that historical records show that DENV outbreaks have occurred in the state [16]. Although there is no evidence for transmission of Chikungunya virus (CHIKV) in the State of Massachusetts, ATM has been shown to be competent vector for CHIKV under laboratory conditions [14]. ATM has also been determined to be the primary vector for recent CHIKV outbreaks in West Africa [6], the Indian Ocean [2, 6], Italy [8] and the Caribbean [11].

ATM has been shown to be vector for canine heartworm (*Dinofilaria immitis*) in Italy [4]. Canine heartworm infections have been rising within the United States for several years, with over one million dogs currently infected [3]. With only ~30% of domestic dogs receiving regular veterinary care [3], canine heartworm could become a major problem for companion animals.

MATERIALS AND METHODS

In the summer of 2015, CMMCP began routine ATM surveillance in our communities by assessing points of likely introduction. These sites include industrial and transport areas, railroad sidings, junkyards and other potential sites. We are currently using two methods of surveillance: the ovitrap and the BG Sentinel™ trap. New methods may be introduced based on evidence from the mosquito research community.
Ovitrap surveillance is conducted by placing small, water-filled cups in several sites in our district. The ovitrap is essentially a 16 oz. plastic cup filled partway with water and all ovitraps are marked with the CMMCP logo [Figure 1]. In this cup, a rough, damp strip of paper is placed to create attractive habitat for ATM and similar species to oviposit their eggs. These damp, mosquito egg-

covered papers are returned to our lab where they are raised in our climate-controlled insectary cabinet until to either the 4th larval instar stage or adulthood. These mosquitoes are then identified to species.

The BG Sentinel™ trap [Figure 2] is manufactured by Biogents AG and is designed with the purpose of catching adult, female ATM. It is a bright white and black plastic collapsible cylinder which contains a fan, power source and ATM-specific attractant bait. Adult mosquitoes attracted to this trap are caught in a downdraft fan and collected in a small net bag. These adults are returned to the CMMCP entomology lab for identification.

2015 Surveillance results:

In the 2015 surveillance season, CMMCP collected ~195 ovitrap samples and ~35 BG Sentinel™ sample collections at 16 sites in our district. We are pleased to report that no introductions of ATM have occurred in our communities as of yet. However, the 2015 season did see documented introductions of ATM in other parts of Massachusetts, with at least one instance very near our district. We propose to continue our surveillance in 2016 and choose new sites as new potential habitats are identified.

Figure 1. The water-filled ovitrap, here shown tied to a fence near a transport corridor in Millbury, MA.

Figure 2. The BG Sentinel™ trap, shown with supplemental CO_2 canister.

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