SPOTLIGHT VECTOR HAZARD REPORT

First report of arbovirus vector *Aedes* (*Fre*.) *vittatus* in the Americas

Photograph: Specimen 1 of 2 collected in Guantanamo Bay, July 2019.

Summary: In July 2019, mosquito specimens were collected in a CO_2-baited CDC light trap on the US Naval Base biosurveillance at Guantanamo Bay Naval Base, Cuba and sent to Public Health Command - Fort Meade as part of routine, on-going surveillance activities. There, Dr. Ben Pagac and Dr. Alex Spring noted two unusually marked females, and brought them to WRBU for further species verification. The specimens were morphologically and molecularly (using mtDNA COI gene & nuclear rDNA ITS2) confirmed as *Aedes* (*Fredwardsius*) *vittatus* (Bigot, 1861) by David Pecor, Jim Pecor and Dr. Yvonne Linton – a finding that represents the first record of this competent arboviral vector in the Americas. The mtDNA barcode signature of both specimens were identical, which may indicate a point-source introduction/interception. Further sampling is needed to determine whether this finding represents interception of this exotic taxa, or represents an established breeding population on the island of Cuba. There are no indications as to the source of the introduction at this time.

Prepared by David Pecor & Yvonne Linton

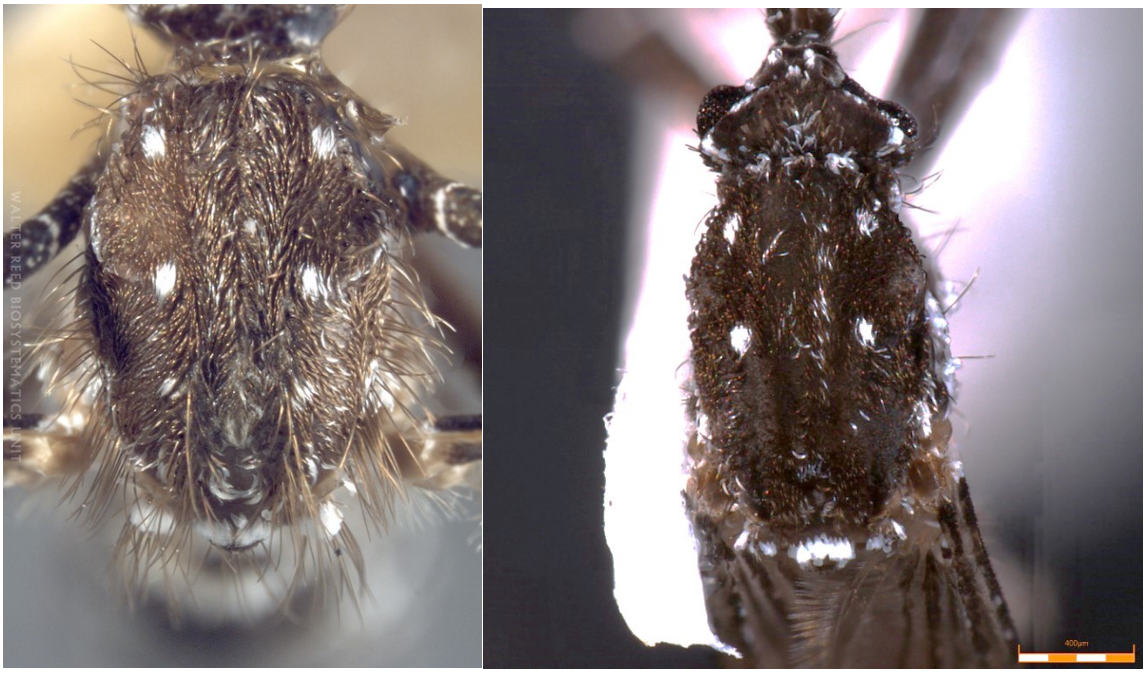
Walter Reed Biosystematics Unit; 26 August 2019

Aedes (*Fredwardsius*) *vittatus* (Bigot, 1861)
Subfamily Culicinae; Tribe Aedini
Informal Name: "Banded French Pointy Mosquito"

Originally described by Bigot in 1861 (as *Culex vittatus*) from collections made on the French Mediterranean island of Corsica, *Aedes vittatus* was later placed in the *Aedes* subgenus *Stegomyia.* Following taxonomic revision, and later backed by molecular phylogenies, *Aedes vittatus* is now regarded as the sole representative of *Aedes* subgenus *Fredwardsius*. There are two currently recognized synonyms: syn. *albopunctata* Theobald, 1907 and syn. *brumpti* Neveu-Lemaire, 1905.

Diagnostic Characters:

Head: Vertex (V) and occiput (Occ) with numerous erect forked scales, not restricted to occiput. Vertex with a median stripe of narrow white scales and with a few narrow white scales scattered on occiput area and along eye margin. Proboscis (P) dark scaled with pale yellowish scales occupying about middle 0.33–0.40. Clypeus with a small patch of narrow white scales on each side. **Thorax:** Mesopostnotum bare; prespiracular area bare; postspiracular setae present; lower mesepimeral setae present. **Scutum:** Acrostichal setae present; 3 pairs of distinct, small, white spots of narrow scales on anterior 0.67 of scutum (on scuttle fossa, posterior scuttle fossa and c. level with the wing root). **Scutellum:** Broad white scales on all three lobes; a few dark scales at apex of mid-lobe. **Wing:** Scales mainly narrow and dark on all veins; scattered pale scales on costa. **Abdomen:** ***S***egment VIII completely retracted. Tergum I with a large median white spot; terga II—VII each with a basal white band and with lateral white curved markings which do not connect with the basal bands. **Legs:** Tibia dark, each with a sub-basal white spot and a white band c. level to the basal third of T-I, T-II, and at mid-point of T-III (anterior view). T-$III_{1\text{-}4}$ with basal white bands [ratio of white band to length of tarsomeres: T-III_1=0.40, T-III_2=0.40, T-III_3=0.50, T-III_4=0.75]; T-III_5 all white (Edwards 1941; Huang & Ward 1981).



Comparison of scutum of pristine NMNH Collection specimen (left) and the rubbed specimen (#1) of *Ae*. *vittatus* (right) from Cuba, showing acrostichal setae and three distinctive pairs of white spots on scutum.

Head (Dorsal): Vertex with a median stripe of narrow white scales and with a few narrow white scales scattered on occiput area and along eye margin. Proboscis (P) dark scaled with pale yellowish scales occupying about middle 0.33–0.40. Clypeus with a small patch of narrow white scales on each side.

Abdomen: Abdominal segment VIII completely retracted. Tergum I with a large median white spot; terga II-VII each with a basal white band and with lateral white curved markings which do not connect with the basal bands.

Aedes vittatus larvae exhibit the following characteristics: Comb with 5–10 thorn-like scales in an irregular row; seta 4-C slightly posteromesad and near seta 6-C; seta 5-C well separated and posterior to setae 4-,6-,7-C; ventral brush with lateral grid bars; pecten with one or more spines widely spaced beyond seta 1-S (Rattanarithikul et al., 2010).

DNA COI barcodes and ITS2 sequence data for *Ae. vittatus* from Cuba are pending publication and are available from WRBU on request.

Bionomics:

Aedes vittatus shares a key bionomic trait with all other globally invasive, highly accomplished *Aedes* fever virus vectors in the *Aedes* subgenus *Stegomyia* (e.g. *Ae. aegypti*, *Ae. albopictus*, *Ae. bromeliae*) – toleration of egg desiccation. This trait allows *Stegomyia* and *Fredwardsius* mosquitoes to disperse widely through global trade,

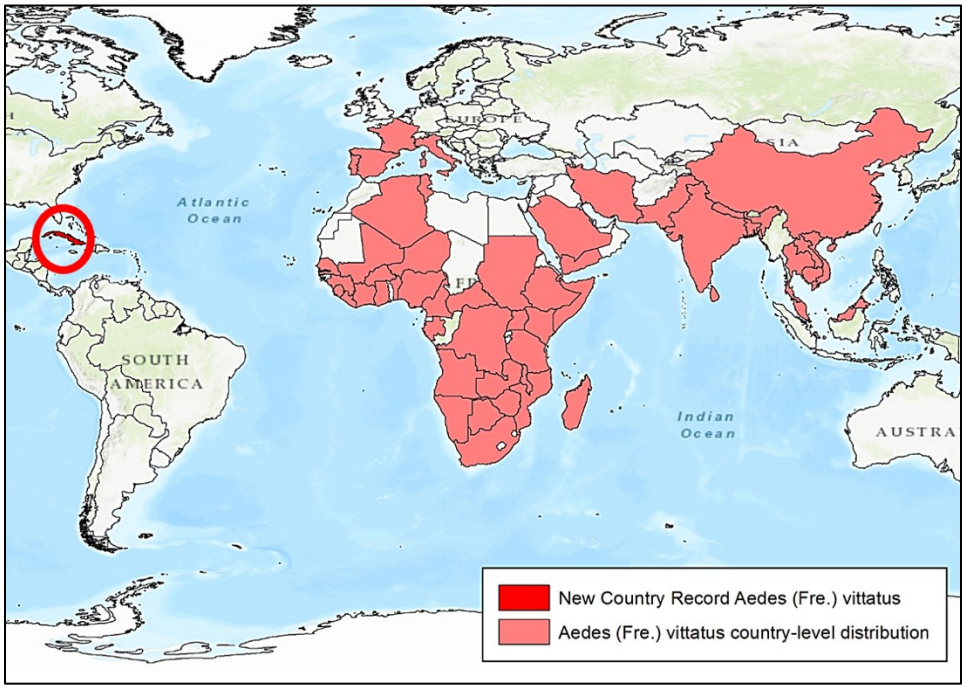
hiding in consignments as eggs, that hatch upon water stimulation in their new environment. *Aedes vittatus* is a hardy species, capable of enduring harsh conditions. It is incredibly tolerant of hot, dry atmospheres, and has been shown to survive the dry season (for at least 10 weeks) as eggs in dried rockpools in the northern African deserts. In addition, studies have shown that *Ae. vittatus* eggs are stimulated to hatch not only by inundation, but by vibrations of the aqueous environment, similar to that caused by rainfall. In Delhi, *Ae. vitattus* immatures have adapted to occupy manmade containers including concrete drainage channels, stone fountains and garden ornaments in the urban areas of Delhi, in addition to their natural habitats of rock holes and rock pools, as well tree holes, bamboo pots, hoof prints and wells. Adults are highly anthropophilic, and commonly comprise the most abundant taxa in human landing collections in Kedougou, Senegal (22.98%).

Biomedical importance: BBKV, CHIK, DEN, ONNV, NRIV, PGAV, SFV, YFV, ZIKA

Like *Ae. aegypti* & *Ae. albopictus*, *Ae. vittatus* is an effective vector of the top four *Aedes* fever viruses – chikungunya, dengue, yellow fever and zika viruses. In Jaipur district (India), 20% of *Ae. vittatus* larvae test showed evidence of vertically transmitted DEN virus, higher than *Ae. albopictus* (18.7%) and *Ae. aegypti* (13.3%) from the same sites (Angel & Joshi, 2008). *Aedes vittatus* is involved in the sylvatic transmission cycle of yellow fever to monkeys; YFV is also passes transovarially in *Ae. vittatus*.

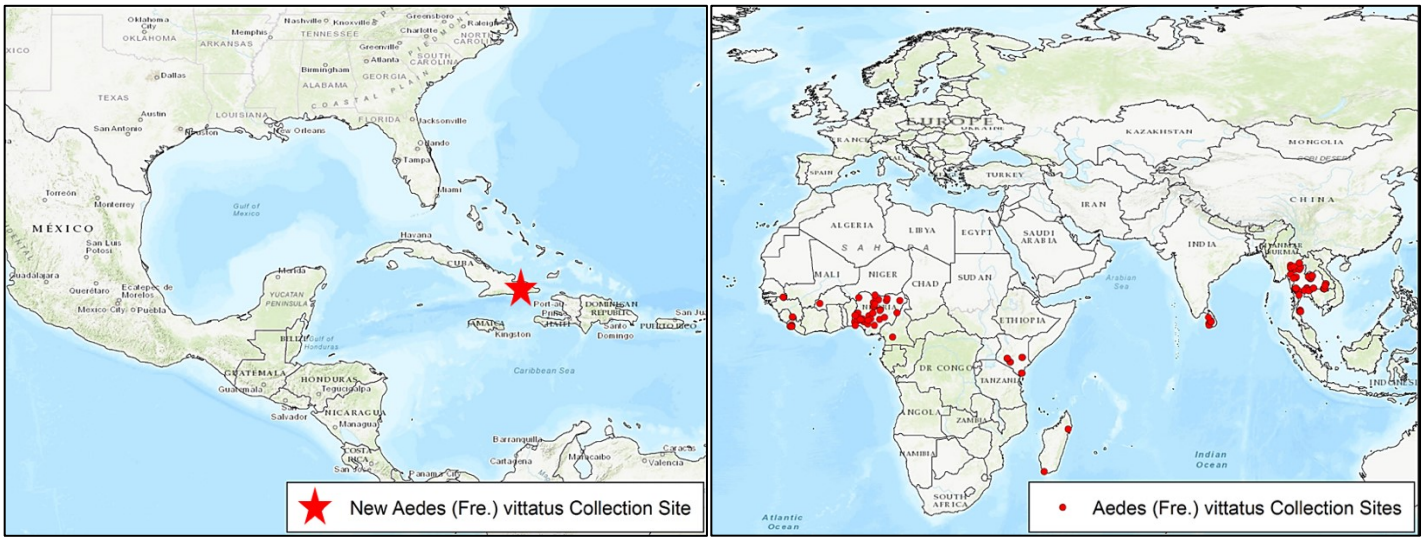
CHIK has been repeatedly isolated from *Ae. vittatus* in Senegal and Cape Verde Islands, and lab infections of these *Ae. vittatus* populations from Senegal and Cape Verde showed high susceptibility (50–100%) and early dissemination and transmission following oral ingestion of CHIK isolates from mosquitoes (ArD30237), bats (CS13-288), and humans (HD180738) (Diagne *et al*., 2014). ZIKV was isolated from *Ae. vittatus* from Cote d'Ivoire (2 strains) and Senegal (>15 isolates) in West Africa (Akoua-Koffi *et al*., 2001; Diallo et al., 2011; Diallo et al., 2012; Adam, 2013). Under lab conditions, Senegalese *Ae. vittatus* were shown to be potentially capable of transmitting ZIKV after 15 dpi with 20% of mosquitoes delivering epidemic (HD 78788) and prototype (MR 766) ZIKV strains in saliva (Diagne *et al*., 2015). The low reported competency of *Ae. vittatus* is discordant with the high abundance of these species and their frequent association with ZIKV in the field in Senegal (Diallo *et al*., 2012; Adam *et al*., 2013). Finding another competent vector of *Aedes*-borne arboviruses in the Caribbean, especially in light of recent epidemics of non-native viral agents in the region, is of significant Public Health concern.

Known distribution of *Aedes vittatus*:



Country-level distribution of *Aedes vitattus* (WRBU, 2019)

Prior to this current invasion into the Caribbean, *Ae. vittatus* has been reported from Europe, Africa, Middle East, Indian subcontinent across Southeast Asia south as far as northern Borneo. Country records include: Algeria, Angola, Bangladesh, Benin, Botswana, Burkina Faso, Cambodia, Cameroon, Central African Republic, Comoros, Cote d'Ivoire, Cuba (herein), Democratic Republic of the Congo, Djibouti, Ethiopia, France (includes Corsica), Gabon, Gambia, Ghana, Guinea, India, Iran, Italy (includes Sardinia), Kenya, Laos, Liberia, Madagascar (includes Glorioso & Juan De Nova Is), Malawi, Malaysia, Mali, Mozambique, Namibia, Nepal, Niger, Nigeria, Pakistan, People's Republic of China, Portugal, Republic of South Africa, Saudi Arabia, Senegal, Sierra Leone, Somalia, Spain (includes Balearic Islands), Sri Lanka, Sudan & South Sudan, Tanzania, Thailand, Tunisia, Uganda, Vietnam, Yemen, Zambia, Zimbabwe.



Location of (U.S. Naval Base, Guantanamo Bay, Cuba).

Surveillance data available on VectorMap (vectormap.si.edu)

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