First Record of Aedes albopictus in Georgia and Updated Checklist of Reported Species

Article *in* Journal of the American Mosquito Control Association · November 2016

DOI: 10.2987/16-6574.1

Journal of the American Mosquito Control Association, 32(3):230–233, 2016

SCIENTIFIC NOTE

FIRST RECORD OF *AEDES ALBOPICTUS* IN GEORGIA AND UPDATED CHECKLIST OF REPORTED SPECIES

TAMAR KUTATELADZE,[1] EKATERINE ZANGALADZE,[1] NATO DOLIDZE,[1] TAMAR MAMATSASHVILI,[1] LAMZIRA TSKHVARADZE,[1] ELIZABETH S. ANDREWS[2] AND ANDREW D. HADDOW[2]

ABSTRACT. Mosquito surveillance was carried out in Batumi, Georgia, in August 2014. *Aedes albopictus* was detected for the first time, which brought the number of reported mosquito species in Georgia to 32. An updated checklist of the mosquitoes of Georgia is provided.

KEY WORDS Black Sea, chikungunya virus, dengue virus, West Nile virus, Zika virus

This report brings the number of mosquito species in Georgia to 32 (Table 1). In an effort to increase the limited knowledge of the geographic distribution of mosquitoes found within Georgia, we report the first collection of *Aedes albopictus* (Skuse) in the country and provide a current checklist of the mosquitoes found within its borders. Collections were made in Batumi during mosquito and arbovirus surveillance training under the Defense Threat Reduction Agency's Cooperative Biological Engagement Program in August 2014.

Mosquito collection locations in Batumi city included 21 sites: Site 1: 41.59891°N, 41.60406°E, tire lot, larvae observed. Site 2: 41.60019°N, 41.61453°E, residential garden with cattle present. Site 3: 41.60447°N, 41.63070°E, tire lot, larvae observed. Site 4: 41.62171°N, 41.61523°E, tire lot, larvae observed. Site 5: 41.62449°N, 41.61005, nursery business with commercial garden, irrigation canal present. Site 6: 41.63237°N, 41.61130°E, tire lot, larvae observed. Site 7: 41.62719°N, 41.61707°E, tire repair shop, tires present. Site 8: 41.63122°N, 41.61130°E, nursery business, irrigation canal present. Site 9: 41.63358°N, 41.61938°E, house with residential garden. Site 10: 41.63419°N, 41.61861°E, lot with residential garden. Site 11: 41.63419°N, 41.61861°E, house with residential garden. Site 12: 41.63705°N, 41.64184°E, house with residential garden with water-holding containers present. Site 13: 41.63419°N, 41.63428°E, house with numerous water-holding containers including tires. Site 14:.41 63543°N, 41.64808°E, house with yard. Site 15: 41.63819°N, 41.64808°E, house with residential garden. Site 16: 41.63252°N, 41.63805°E, house with small water reservoirs in yard. Site 17: 41.63098°N, 41.63530°E, property bordered by bamboo trees. Site 18: 41.63537°N, 41.63440°E, house with cattle and water barrels, larvae observed. Site 19: 41.63498°N, 41.64482°E, tire lot, larvae observed. Site 20: 41.64401°N, 41.65217°E, house with yard. Site 21: 41.64370°N, 41.64425°E, multiple family residence with yard.

Mosquitoes were collected through a combination of techniques: Centers for Disease Control and Prevention (CDC) light traps with and without CO_2 (logistical constraints limited the use of dry ice), mouth aspirators, and a modified CDC backpack aspirator (John W. Hock Company, Gainesville, FL). The CO_2-baited CDC traps were set with a cooler of approximately 2 kg of dry ice. All CDC traps were suspended approximately 1 m above the ground. Adult mosquitoes were identified (Harbach 1985, Glick 1992, Darsie and Samanidou-Voyadjoglou 1997, Azari-Hamidian and Harbach 2009), sorted by species and sex, and placed into pools containing 1 to 20 mosquitoes for pathogen screening.

In total, 3,414 (253 pools) *Aedes* spp. were screened for dengue viruses (DENV), and 496 (97 pools) *Culex pipiens* L. were screened for West Nile virus (WNV). Pools were homogenized in phosphate buffered saline (Sigma-Aldrich, St. Louis, MO), and RNA was extracted using the QIAamp viral RNA mini kit (Qiagen, Valencia, CA). Viral RNA was then analyzed for DENV 1–2 and WNV by quantitative reverse transcriptase polymerase chain reaction (qRT-PCR) on an ABI 7500 Real-Time PCR System (Life Technologies, Rochester, NT) using the Platinum Taq DNA Polymerase kit (Invitrogen) and virus-specific primers and probes (Lanciotti et al. 2000, Johnson et al. 2005). None of samples tested positive for the above-mentioned viruses.

All mosquitoes collected were examined by species, sex, and collection method as follows: *Aedes aegypti* (L.): Specimens examined: Batumi city: Site 3, August 5, 2014, 3♀, mouth aspirator; August 7, 2014, 2♀, mouth aspirator; August 10, 2014, 1♀, CO_2-baited CDC trap; August 10, 2014, 1♂, backpack aspirator; August 11, 2014, 3♀,1♂, CO_2-

[1] National Center for Disease Control and Public Health, 9 Mikheil Asatiani Street, Tbilisi, Georgia 380077.

[2] United States Army Medical Institute of Infectious Diseases, Virology Division, 1425 Porter Street, Fort Detrick, MD 21702.

Table 1. Updated check list of the mosquito species of Georgia.

Species	Reference
Aedes (Stegomyia) aegypti	Kandelaki 1926
Ae. (Stg.) albopictus	This study
Ae. (Ochlerotatus) caspius	Kalandadze 1929
Ae. (Aedes) cinereus	Kalandadze 1929
Ae. (Stg.) cretinus	Rukhadze 1926
Ae. (Och.) excrucians	Shakhov 1925
Ae. (Dahliana) geniculatus	Skorikov 1906
Ae. (Och.) intrudens	Mgeladze 1990
Ae. (Och.) pulcritarsis	Skorikov 1906
Ae. (Och.) punctor	Mgeladze 1991
Ae. (Och.) sticticus	Sichinava 1970
Ae. (Aedimorphus) vexans	Mgeladze 1991
Anopheles (Anopheles) algeriensis	Kanchaveli 1955
An. (Ano.) claviger	Favr 1903
An. (Ano.) hyrcanus	Favr 1903
An. (Ano.) maculipennis	Kalandadze 1929
An. (Ano.) melanoon	Kalandadze and Sagatelova 1938
An. (Ano.) plumbeus	Rukhadze 1926
An. (Ano.) sacharovi	Kalandadze and Mchedlidze 1930
An. (Cellia) superpictus	Kanchaveli 1955
Culex (Maillotia) hortensis	Rukhadze 1925
Cx. (Culex) mimeticus	Kalandadze 1929
Cx. (Barraudius) modestus	Rukhadze 1926
Cx. (Cux.) pipiens	Sichinava 1972
Cx. (Neoculex) territans	Kalandadze 1929
Cx. (Cux.) theileri	Kandelaki 1926
Culiseta (Culiseta) alaskaensis indica	Maslov 1967
Cu. (Cus.) annulata	Kalandadze 1929
Cu. (Culicella) fumipennis	Sichinava 1970
Cu. (Allotheobaldia) longiareolata	Kandelaki 1926
Cu. (Cuc.) morsitans	Zabudco-Reingard 1937
Uranotaenia (Pseudoficalbia) unguiculata	Kalandadze 1929

baited CDC trap; August 16, 2014, 2♂, backpack aspirator; August 19, 2014, 1♂, backpack aspirator.

Aedes albopictus (Skuse); Specimens examined: Batumi city: Site 1, August 5, 2014, 24♀, CDC trap; August 7, 2014, 92♀, 14♂; August 8, 2014, 124♀ (8 blood-fed), 78♂, backpack aspirator; August 10, 2014, 95♀, CDC trap; August 10, 2014, 56♀, 59♂, backpack aspirator; August 11, 2014, 309♀, CDC trap; August 16, 2015, 178♀, 83♂, backpack aspirator; August 16, 2014, 8♀, CDC trap; August 17, 2014, 18♀, CDC trap; August 19, 2014, 34♀, 102♂, backpack aspirator; August 20, 2014, 199♀ (1 blood-fed), 116♂, backpack aspirator; August 20, 2014, 75♀, 2♂, CDC trap**.** Site 2, August 5, 2014, 1♀, CO_2-baited CDC trap; August 7, 2014, 1♀, mouth aspirator; August 10, 2014, 4♀, CO_2-baited CDC trap; August 16, 2015, 3♀, CDC trap; August 17, 2014, 2 ♀, backpack aspirator. Site 3, August 5, 2014, 20♀, CO_2-baited CDC trap; August 7, 2014, 59♀, 26♂, mouth aspirator; August 10, 2014, 92♀, 97♂, backpack aspirator; August 10, 2014, 2♀, CO_2-baited CDC trap; August 11, 2014, 78♀, 2♂, CO_2-baited CDC trap; August 16, 2014, 84♀, 122♂, backpack aspirator; August 16, 2014, 4♀, CDC trap; August 17, 2014, 9♀, CDC trap; August 19, 2014, 31♀, 107♂, backpack aspirator; August 20, 2014, 7♀, 1♂, CDC trap. Site 4, August 10, 2014, 8♀, CO_2-baited CDC trap; August 11, 2014, 11♀,1♂, CO_2-baited CDC trap; August 16, 2014; 76♀ (2 blood-fed), 37♂, backpack aspirator; August 16, 2014, 5♀, CDC trap; August 17, 2014, 11♀, CDC trap; August 20, 2014, 38♀, 67♂, backpack aspirator. Site 5, August 5, 2014, 22♀, CO_2-baited CDC trap. Site 6, August 5, 2014, 1♀, CO_2-baited CDC trap; August 10, 2014, 7♀ (1 blood-fed), CO_2-baited CDC trap; August 11, 2014, 25♀, CO_2-baited CDC trap; August 21, 2014, 68♀ (1 blood-fed), 51♂, backpack aspirator. Site 7, August 5, 2014, 10♀, CO_2-baited CDC trap. Site 8, August 5, 2014, 9♀, CO_2-baited CDC trap. Site 9, 6♀ (1 blood-fed), CO_2-baited CDC trap. Site 10, August 5, 2014, 7♀, CO_2-baited CDC trap; August 9, 2014, 4♀, 7♂, backpack aspirator. Site 13, 41 63419 N, 041 63428 E, August 14, 2014, 1♂, CDC trap. Site 14, August 6, 2014, 3♀, 1♂, CO_2-baited CDC trap. Site 15, August 6, 2014, 5♀, CO_2-baited CDC trap; August 14, 2014, 2♀, CDC trap. Site 16, August 13, 2014, 14♀, CDC trap. Site 17, August 13, 2014, 6♀ (1 blood-fed), 2♂, CDC trap. Site 18, August 6, 2014, 9♀, CO_2-baited CDC trap; August 10, 2014, 3♀, CO_2-baited CDC trap; August 11, 2014, 33♀, CO_2-baited CDC trap; August 13, 2014, 2♀, 2♂, CDC trap; August 14, 2014, 3♀, 1♂, CDC trap; VII.21, 2014, 55♀, 41♂, backpack aspirator. Site 19, August 11, 2014, 92♀ (5 blood-fed), 86♂, backpack aspirator; August 11, 2014, 13♀, CO_2-baited CDC trap; August 17, 2014, 73♀, 36♂, backpack aspirator; August 20, 2104, 2♀, 3♂, CDC trap. Site 20, August 13, 2014, 2♀, CO_2-baited CDC trap.

Culex pipiens L.: Specimens examined: BATUMI: Specimens examined: Site 1, August 9, 2014, 2♂, backpack aspirator; August 20, 2014, 11♀ (7 blood-fed), 14♂, backpack aspirator. Site 2, August 5, 2014, 1♀, CO_2-baited CDC trap. Site 3, August 10, 2014, 1♂, backpack aspirator; August 16, 2014, 4♀ (blood-fed), backpack aspirator; August 20, 2014, 4♀, 2♂, CDC trap. Site 4, August 16, 2014, 6♀ (2 blood-fed), 1♂, backpack aspirator; August 20, 2014, 1♀, CDC trap. Site 5, August 5, 2014, 36♀, CO_2-baited CDC trap. Site 6, 41 63237 N, 041 61130 E, August 5, 2014, 6♀, CO_2-baited CDC trap, August 21, 2014, 2♀, 2♂, backpack aspirator. Site 7, August 5, 2014, 1♀, CO_2-baited CDC trap. Site 8, August 5, 2014, 78♀, 1♂, CO_2-baited CDC trap. Site 9, August 5, 2014, 11♀, CO_2-baited CDC trap. Site 10, August 5, 2014, 3♀, CO_2-baited CDC trap; August 9, 2014, 1♀, ♂2, backpack aspirator. Site 11, August 13, 2014, 2♀, CDC trap. Site 12, August 13, 2014, 2♀, 3♂, CDC trap; August 14, 2014, 4♀, CDC trap. Site 13, August 6, 2014, 17♀, CO_2-baited CDC trap, August 13, 2014, 3♀, 1♂, CDC trap, August 14, 2014, 9♀, 1♂, CDC trap. Site 14, August 6, 2014,

8♀, CO_2-baited CDC trap; August 13, 2014, 4♀, 2♂, CDC trap; August 14, 2014, 3♀, 1♂, CDC trap; August 19, 2014, 1♀, 2♂ CDC trap. Site 15, August 6, 2014, 5♀, CO_2-baited CDC trap; August 14, 2014, 5♀, 4♂, CDC trap; August 19, 2014, 6♀, 4♂, CDC trap. Site 16, August 13, 2014, 3♂, CDC trap; August 14, 2014, 4♀, 1♂, CDC trap; August 19, 2014, 8♀, CDC trap; August 20, 2014, 7♀, 2♂, CDC trap. Site 17, August 14, 2014, 11♀, 4♂, CDC trap; August 19, 2014, 8♀, 2♂, CDC trap. Site 18, August 6, 2014, 9♀, CO_2-baited CDC trap; August 10, 2014, 2♀, CO_2-baited CDC trap; August 14, 2014, 8♀, 1♂, CDC trap; August 19, 2014, 8♀, 2♂, CDC trap; August 21, 2014, 6♀, 4♂, backpack aspirator. Site 19, August 11, 2014, 13♀ (5 blood-fed), 1♂, backpack aspirator; August 17, 2014, 2♀ (2 blood-fed), 7♂, backpack aspirator; August 20, 2014, 3♀, CDC trap. Site 20, August 10, 2014, 13♀, CO_2-baited CDC trap, August 11, 2014, 1♀, CO_2-baited CDC trap; August 13, 2014, 5♀, CDC trap; August 14, 2014, 4♀, CDC trap; August 16, 2014, 4♀, CDC trap; August 19, 2014, 14♀, 2♂, CDC trap; August 20, 2014, 8♀ (2 blood-fed), CDC trap. Site 21, August 14, 2014, 6♀, 1♂, CDC trap; August 19, 2014, 4, 2, CDC trap; August 20, 2014, 12♀, 8♂, CDC trap.

The current knowledge of the species, distribution, and mosquito-associated pathogens in Georgia is limited. As such, this project was designed to provide training to prepare for the initiation of surveillance activities in Batumi, a city that has received little attention in recent years. Batumi is a popular vacation location on the Black Sea coast. It is densely populated and has a busy port with rail and road networks that enable the dispersal and/or introduction of invasive mosquitoes and their associated pathogens.

At the time of the study, vector control efforts in Batumi were nonexistent. Throughout the city, the study team observed numerous water-holding containers with the presence of mosquito larvae and that the majority of homes lacked screens. While DENV-1 and –2 as well as WNV were not detected during limited sampling efforts, the vectors of these viruses as well as chikungunya, Zika, and yellow fever viruses are present in Batumi (e.g., *Ae. aegypti*, *Ae. albopictus*, and *Cx. pipiens*).

The discovery of *Ae. albopictus* was not a surprise because it has been reported from both Russia and Turkey (Riabova et al. 2005, Iunicheva Iu et al. 2008, Oter et al. 2013) but is concerning due to the number of arboviral pathogens this species is capable of transmitting (Hawley 1988, Gratz 2004). Although *Ae. albopictus* was more abundant and had a larger geographic distribution in Batumi than *Ae. aegypti* during our limited sampling efforts, the lack of previous mosquito surveillance activities makes it difficult to determine the effect of interspecific competition between these 2 species. The results of this study highlight the need for continued arbovirus surveillance, as well as the implementation of vector control and public health education programs focusing on preventing mosquito-borne diseases in Batumi.

This study was funded by the Defense Threat Reduction Agency (DTRA) Cooperative Biological Engagement Program (CBEP). The authors wish to thank Rik Obiso, Theresa Gallagher, and Magda Metreveli for their assistance in the coordination of logistical activities. The views expressed in this article are those of the authors and do not represent the official policy or position of the US Department of the Army, Department of Defense, or the US Government.

REFERENCES CITED

Azari-Hamidian S, Harbach RE. 2009. Keys to the adult females and fourth-instar larvae of the mosquitoes of Iran (Diptera: Culicidae). *Zootaxa* 2078:1–33.

Darsie RE, Samanidou-Voyadjoglou A. 1997. Keys for the identification of the mosquitoes of Greece. *J Am Mosq Control Assoc* 13:247–254.

Favr VV. 1903. [*Malaria in respect to sanitary conditions in Russia*.] Kharkov. Russian.

Glick JI. 1992. Illustrated key to the female *Anopheles* of Southwestern Asia and Egypt (Diptera: Culicidae). *Mosq Syst* 24:125–153.

Gratz NG. 2004. Critical review of the vector status of *Aedes albopictus*. *Med Vet Entomol* 18:215–227.

Harbach RE. 1985. Pictorial keys to the genera of mosquitoes, subgenera of *Culex* and the species of *Culex* (Culex) occurring in Southwestern Asia and Egypt, with a note on the subgeneric placement of *Culex deserticola* (Diptera: Culicidae). *Mosq Syst* 17:83–107.

Hawley WA. 1988. The biology of *Aedes albopictus*. *J Am Mosq Control Assoc* 1(Suppl):1–39.

Iunicheva Iu V, Riabova TE, Markovich N, Bezzhonova OV, Ganushkina LA, Semenov VB, Tarkhov GA, Vasilenko LE, Guzeeva TM, Shevereva TV, Sergiev VP. 2008. [First evidence for breeding *Aedes aegypti* L in the area of Greater Sochi and in some towns of Abkhasia.] *Med Parazitol (Mosk)* 3:40–43. Russian.

Johnson BW, Russell BJ, Lanciotti RS. 2005. Serotype-specific detection of dengue viruses in a fourplex real-time reverse transcriptase PCR assay. *J Clin Microbiol* 43:4977–4983.

Kalandadze LP. 1929. [Studies of the general biology of mosquitoes in Georgia.] *Proc Trop Med* 3:218–222. Georgian.

Kalandadze LP, Mchedlidze IZ. 1930. [Studies of the biology of *Gambusia*.] *Proc Trop Med* 1:87–93. Georgian.

Kalandadze LP, Sagatelova IS. 1938. [Distribution of *Anopheles maculipennis* in Georgia.] *Med Parazitol (Mosk)* 7:878–880. Russian.

Kanchaveli GI. 1955. [*Study of the fauna, biology and role of malaria transmission in various species of malarial mosquitoes in Georgia SSR* (Thesis)]. Virsaladze Scientific Research Institute of Medical Parasitology and Tropical Medicine. Tbilisi, Georgia. Georgian.

Kandelaki SP. 1926. [Study of the mosquitoes of the Caucasus.] *Proc Trop Med Central Station* 1:86–92. Russian.

Lanciotti RS, Kerst AJ, Nasci RS, Godsey MS, Mitchell CJ, Savage HM, Komar N, Panella NA, Allen BC, Volpe KE, Davis BS, Roehrig JT. 2000. Rapid detection of

West Nile virus from human clinical specimens, field-collected mosquitoes, and avian samples by a TaqMan reverse transcriptase-PCR assay. *J Clin Microbiol* 38:4066–4071.

Maslov AV. (ed.) 1967. *Blood-sucking mosquitoes of the subtribe Culisetina (Diptera, Culicidae) in world fauna*. Leningrad, Russia: Nauka.

Mgeladze VM. 1990. [A new species of mosquito (Diptera: Culicidae) in Georgia.] *Bull Acad Sci Georgia* 138:621–623. Russian.

Mgeladze VM. 1991. [Species composition of the genus *Aedes* (Diptera: Culicidae) in Georgia.] *Bull Acad Sci Georgia* 143:329–331. Russian.

Oter K, Gunay F, Tuzer E, Linton YM, Bellini R, Alten B. 2013. First record of *Stegomyia albopicta* in Turkey determined by active ovitrap surveillance and DNA barcoding. *Vector Borne Zoonotic Di*s 13:753–761.

Riabova TE, Iunicheva Iu V, Markovich N, Ganushkina LA, Orabei VG, Sergiev VP. 2005. [Detection of *Aedes* (Stegomyia) *aegypti* L. mosquitoes in Sochi city.] *Med Parazitol (Mosk)* 3:3–5. Russian.

Rukhadze NP. 1925. [The biology and distribution of *Anopheles* mosquitoes in Abkhazia.] *J Trop Med* 1–3:45–49. Georgian.

Rukhadze NP. 1926. [Hibernation of *Anopheles* and *Stegomyia* mosquitoes in Abkhazia.] *Proc Sci Soc Abkhazia* 3:87–93. Russian.

Shakhov SD. 1925. [Results of an entomological expedition in Abkhazia.] *Proc Sci Soc Abkhazi*a 8:34–43. Russian.

Sichinava SG. 1970. [Biology and ecology of mosquitoes (Diptera: Culicidae) and their management in Abkhazia (dissertation)]. Martsinovski Institute of Medical Parasitology and Tropical Medicine. Moscow, USSR. Russian.

Sichinava SG. 1972. [Distribution of *Culex pipiens molestus* Forskal in Abkhazia.] In: Abstracts of Scientific Reports of the 21st Session of the Institute of Medical Parasitology and Tropical Medicine, 1972 December 20; Tbilisi, Georgia. p. 27–29. Georgian.

Skorikov AS. 1906. [Surveillance of malaria-carrying mosquitoes in Gagra.] *Russian Observer* 3–4:225–254. Russian.

Zabudco-Reingard TN. 1937. [Studies of the systematics and biology of the mosquitoes in Abkhazia.] *Proc Rukhadze N.P. Trop Insti Abkhazia* 3:26–46. Russian.