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First report of *Culex (Culex) tritaeniorhynchus* Giles, 1901 (Diptera: Culicidae) in the Cape Verde Islands

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Keywords: Culicidae, *Culex tritaeniorhynchus*, Cape Verde Islands, first occurrence.

ABSTRACT

During an entomological survey in Santiago Island, Cape Verde Islands, in November-December 2011 in order to study the bio-ecology and susceptibility to insecticides of *Anopheles arabiensis* Patton, 1905, *Culex tritaeniorhynchus* Giles, 1901 was found to be present in the Santa Cruz District. Both adult and immature specimens were collected and a description of both is given. Further confirmation of the taxonomic identity of the specimens was obtained from studying the male genitalia. This is the first known occurrence of *Culex tritaeniorhynchus* (a primary vector of Japanese encephalitis in eastern and southern Asia and a potential vector of West Nile Virus, Sindbis and Rift Valley Fever Virus) in the Cape Verde Islands.

RESUMO

Durante um levantamento entomológico realizado na ilha de Santiago, arquipélago de Cabo Verde, em Novembro-Dezembro de 2011, com o objectivo de estudar a bioecologia e susceptibilidade de *Anopheles arabiensis* Paton, 1905, foi encontrado *Culex triteaniorhynchus* Giles, 1901, no Concelho de Santa Cruz. Foram recolhidos, identificados e descritos espécimes quer no estado adulto quer na forma do quarto estadio larvar. A identificação taxonómica foi posteriormente confirmada através do estudo da genitália de machos. Relata-se pela primeira vez, nas ilhas de Cabo Verde, a ocorrência de *Culex triteaniorhynchus,* vector primário do vírus da Encefalite Japonesa na Ásia Oriental e do Sul e vector potencial dos seguintes vírus: o da febre do Nilo Ocidental, Sindbis e febre do Vale do Rift.

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INTRODUCTION

Updating knowledge of the culicidean fauna of the Cape Verde Islands has been a priority for many years (e.g. Ribeiro *et al.* 1980, Cambournac *et al*. 1982, Alves *et al*. 2010). During an entomological survey, conducted between November and December 2011, in order to study the bio-ecology and susceptibility to insecticides of *Anopheles arabiensis* Patton, 1905 in Santiago Island, *Culex (Culex) tritaeniorhynchus* Giles, 1901 was found to be present in the Santa Cruz district (Fig. 1). We describe the site and provide descriptions of both adult and larval stages.

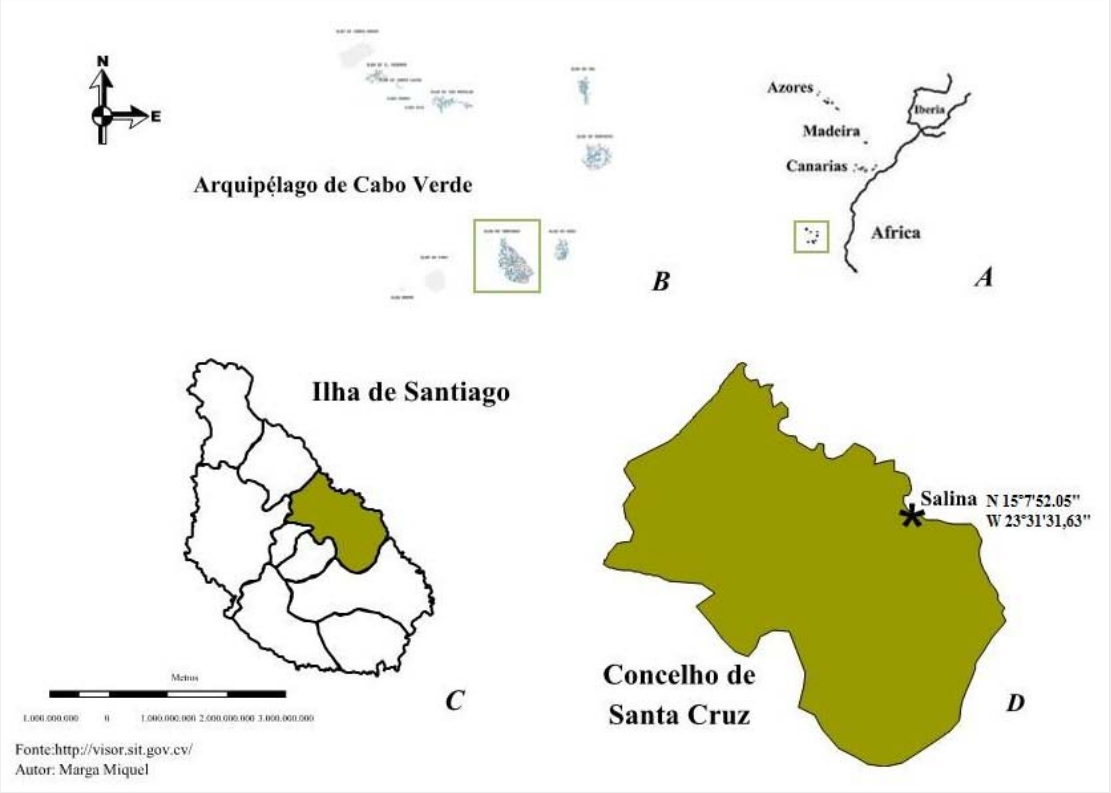

Fig. 1. Maps of Santiago Island and the Santa Cruz district, indicating (*) the locality where specimens of *Culex tritaeniorhynchus* were found.

The habitat consisted of a natural basin of rain water drainage in a confluent zone between a lagoon and a beach in a coastal region (Fig. 2). The breeding site was exposed to sunlight, characterized by the presence of emergent and fluctuant aquatic vegetation and the water was slightly brackish, but within the limits of being considered freshwater. So far, only *Culex ethiopicus* Edwards, 1912 had been found breeding at this and similar sites in the area. *Culex tritaeniorhynchus* is considered a primary vector of Japanese encephalitis in eastern and southern Asia (van den Hurk *et al.* 2009). It is also a potential vector of West Nile Virus (WNV), Sindbis and Rift Valley Fever Virus (RVFV) (Wills *et al.* 1985, Kheir *et al*. 2010). The presence of *C. tritaeniorhynchus* in this area underlines the need for further investigations into its significance for public health and epidemiological issues.

MATERIAL AND METHODS

We visited localities in five districts of Santiago Island to collect immature stages of mosquitoes at several breeding sites, including ponds, pools, pits and tanks. Upon collection, all immature mosquitoes were placed in containers and transported to the laboratory, where they were reared until

they emerged as adults. In addition, adult mosquitoes were collected with CDC light traps (placed in local people's bedrooms and in sheds for cattle, goats and sheep) and by using pyrethrum spray in human dwellings. After collection, mosquito specimens were sorted, counted and identified morphologically using a stereomicroscope and according to the identification keys provided by Ribeiro & Ramos (1995).

Fig. 2. Partial view of the breeding site of *Culex tritaeniorhynchus*, Santa Cruz district, Santiago Island, Cape Verde Islands, where specimens were collected (photo by Ibrahima Dia; © Joana Alves).

RESULTS

A total of 2,192 mosquito specimens were identified. The distribution by district and capture method is given in Table 1. A large majority of specimens were immatures (94.1%), followed by resting females from human dwellings. Specimens from CDC light traps in bedrooms and sheds were the least abundant (0.4% and 0.1% respectively). From the total of emerged specimens, *Culex* spp. averaged 7%, while in the district of Santa Cruz the average of emerged *Culex* spp. was 27%. In most samples, *Culex* spp. were found in association with *Anopheles gambiae s.l.* Giles, 1902 and *A. pretoriensis* (Theobald, 1903).

While identifying the collected mosquitoes, we found specimens with a median pale ring in the proboscis. Using the key of Ribeiro & Ramos (1995), 136 specimens were identified as *C. tritaeniorhynchus*. The identification of 4th instar larvae confirmed this. Identification was also confirmed by the morphology of the male genitalia (Fig. 3) (cf. Ribeiro 1966, Harbach 1988).

ADULTS Pale ring of female proboscis extending just to the base, absence of low mesepimeral setae, absence of pale scales on femora; scutum dark brown with pale scales almost completely confined to near scutellum; abdominal tergites with basal pale bands; wings without pale disseminated scales.

LARVAE Mentum with well developed teeth; comb of the abdominal segment VIII composed entirely by typical scales without spine or spiniform scales in number between 30-45; syphon light brown to nearly colorless; pecten of the syphon simple at tip; subventral tufts of the syphon smaller than the diameter, usually with 3-4 branches, rarely 2; head setae 5, 3-branched; pre-clipeal spines brawn and strong; anal brush without median tufts.

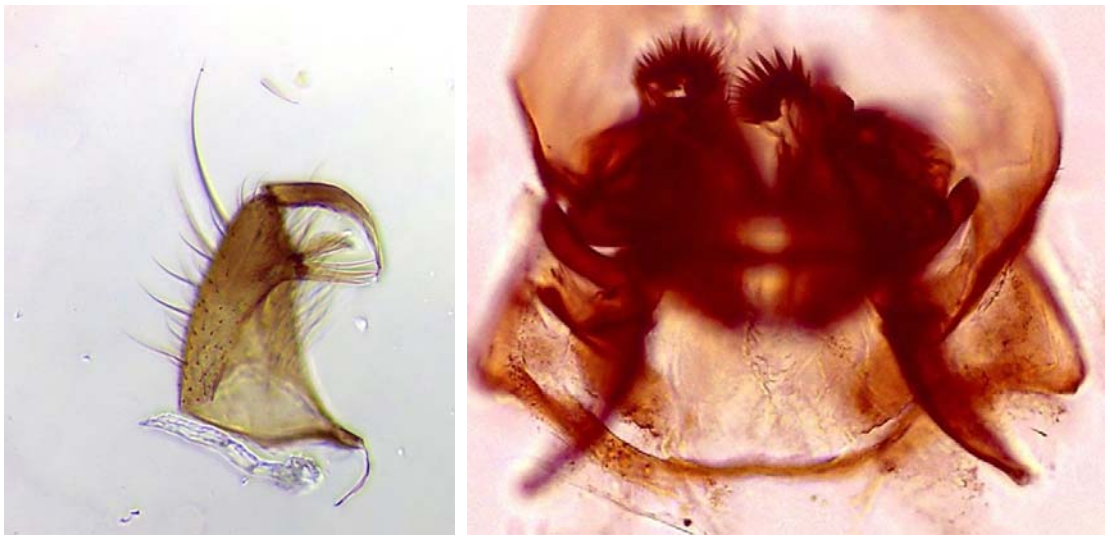

Fig. 3. Left: coxite of male terminalia of *Culex triteaniorhynchus* from Santa Cruz, Santiago, Cape Verde Islands (magnification x1000). Right: Basal parts (frontal view) of the male terminalia of *Culex triteaniorhynchus* from Santa Cruz, Santiago, Cape Verde Islands (magnification x1000).

Species	Collecting method	Praia	Santa Cruz	Santa Catarina	São Miguel	Tarrafal
Anopheles pretoriensis	immature stages	894	241	60	250	30
Anopheles gambiae		12	36	5	45	21
Culex pipiens		21	86	8	15	41
Aedes aegypti		89	0	0	0	43
Culex tigripes		0	4	0	7	5
Culex tritaeniorhynchus		0	136	0	0	0
Culex ethiopicus		0	0	0	3	0
Aedes caspius		0	0	0	10	1
Subtotal		**1016**	**503**	**73**	**330**	**141**
Culex pipiens	spray catches	11	53	0	54	0
Subtotal		**11**	**53**	**0**	**54**	**0**
Culex pipiens	CDC in bedroom	7	1	0	0	0
Subtotal		**7**	**1**	**0**	**0**	**0**
Anopheles pretoriensis	CDC in cowshed	0	0	0	0	2
Culex pipiens		0	0	0	0	1
Subtotal		0	0	0	0	3
TOTAL		**1034**	**557**	**72**	**584**	**144**

Table 1. Distribution of mosquito specimens by collecting method in the five districts of Santiago Island prospected.

DISCUSSION

Culex tritaeniorhyncus, a mosquito with a cosmopolitan distribution, is considered a primary vector of JEV (Flavivirus: Flaviviridae) (Self *et al*. 1973, Takahashi 1977, van den Hurk *et al*. 2009), a disease that mainly affects children in the Asian region, with a lethality rate of around 30% (Nett *et al.* 2009). It is also a vector of WNV (Flavivirus: Flaviviridae), considered an emerging vector-borne disease in some parts of the world due to the increased circulation of people and trade goods as a consequence of globalization, while migratory birds may also play a role (Kanojia & Geevarghese 2004, Medlock *et al*. 2005), as well as SINV (Alfavirus: Togaviridae) and the Rift Valley fever virus (Plebovirus: Bunyaviridae) (Kheir *et al*. 2010). The occurrence of *Culex tritaenyorhynchus* in the Cape Verde Islands prompts the need for focused follow-up investigations in order to evaluate its possible implication in the transmission of vector-borne pathogens in the archipelago. The presence of this species, with its large trophic range (cattle, pigs, birds, humans) (Bram 1967) and as a potential transmitter of Japanese encephalitis, may introduce yet another vector-born emerging disease and calls for close monitoring. Therefore, practical measures for its surveillance and control, including pathogen isolation, must be taken. At the same time, investigations on other arboviruses, such as WNV, Sindbis and Valley Rift fever virus, transmitted by *Culex pipiens pipiens* L., 1758 and *Culex perexiguus* Theobald, 1903 (Jupp *et al*. 1986, Turell *et al*.1996, 2002, Jupp 2001, Orshan *et al*. 2008), species both known to occur in Cape Verde, should not be neglected.

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