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Additional records of vector mosquito diversity collected from Al Khor district of North-eastern Qatar

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ABSTRACT

Objective: To survey mosquito diversity in the north-eastern area, which includes the most important gas industrial city in Qatar, and to investigate the potential mosquitoes for transmitting diseases.

Methods: A study was performed from September 2009 until June 2011 in Al-Khor district of North-eastern Qatar. Five localities were selected for larval collection: Al Khor City (the main city), Al Dhakira, Ras Laffan (gas industrial city), Simsimah and Al Ghuwariyah. The survey was carried out by using different sampling methods and covering all expected natural breeding sites. The larvae were collected, preserved and transferred to the laboratory for identification.

Results: Our findings revealed that 10 species of mosquito larvae had been detected from the area and five of them were new records in Qatar. The species encountered were: *Ochlerotatus caspius* (Pallas 1771), *Anopheles stephensi* (Liston 1901), *Culex quinquefasciatus* (Say 1823) (*Cx. quinquefasciatus*), *Culex pipiens* biotype molestus (Forsk. 1775) (*Cx. pipiens*), *Culex univittatus* (Theobald 1901), *Culex pusillus* (Macquart 1850), *Culex tritaeniorhynchus* (Giles 1901) (*Cx. tritaeniorhynchus*), *Culex laticinctus* (Edwards 1913), *Culex sitiens* (Weidmann 1828) and *Culex perexiguus* (Theobald 1901). The new recorded species were *Cx. quinquefasciatus*, *Cx. tritaeniorhynchus*, *Culex laticinctus*, *Culex sitiens* and *Culex perexiguus*. The most prevalent type was *Cx. pipiens* molestus (31.29%) and followed by *Culex pusillus* and *Cx. quinquefasciatus* which have relatively similar prevalence of 18.72% and 18.52% respectively. *Anopheles stephensi* was an established vector for malaria. *Cx. pipiens* molestus and *Cx. quinquefasciatus* were vectors of West Nile virus and filariasis. *Cx. tritaeniorhynchus* was established as a vector of Rift Valley virus and *Culex univittatus* was the main vector of Sindbis virus.

Conclusions: The north-eastern area of Qatar harbors is the most important industrial city in the country, which has witnessed an increase in the number of expatriate people. Because of the increase of reported mosquitoes, there is an urgent need for a surveillance program. This will allow us to build a database of mosquito vectors in the area.

1. Introduction

The north-eastern district area has been changed completely over the last two decades due to the development of the gas industry in Qatar and Ras Laffan has been adopted as the largest and most important industrial city in the state. Also, the area has a large community of expatriates living and working in gas industrial area and adjacent vicinities. Coincidentally, the increased number of complaints of mosquito bites, the lack of information about the mosquito species and varieties in the region promote us to conduct study in the different localities of the district.

1.1. Geography and climate of Qatar

The Qatari Peninsula, lying between longitude 50°45'–51°40' E and latitude 24°27'–26°10' N, is an extension of the Arabian Desert with very hot summer and mild winter. The mean annual temperature is 42 °C while the minimum can reach 12 °C. The peninsula is characterized by scanty rainfall with an average rainfall of 78 mm/annum. The major area of the Qatari desert is less than 40 m above sea level, and most of it is flat or elevated land covered by stones and gravel. However, some localities are characterized by special physical and biotic features. Among these are surface depressions (locally named Rodat) which receive run-off water, rich in silt and mud during the rainy season. The Rodat is harboring denser vegetation than the surrounding desert. The southwest part is bordered by sand

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dunes which have deep sand deposits traversed by runnels and wadis while the saline flat (locally named sabkha) is extended along the western part[1].

1.2. The available records of mosquito larvae in Qatar

The available literature revealed only one report which addressed larval stages through the routine work of municipal collection activities[2]. Five municipal districts from the seven adopted municipalities have been scanned. Six species were recorded which included: *Aedes caspius* (Macquart 1901), *Anopheles multicolor* (Cambouliu), *Anopheles stephensi* (Liston) (*An. stephensi*), *Culex pipiens* complex (L.) (*Cx. pipiens* complex), *Culex univittatus* (Theobald 1901) (*Cx. univittatus*) and *Culex pusillus* (Macquart 1850) (*Cx. pusillus*). However, only two types have been recorded from the north-eastern area. They were *Cx. pipiens* complex and *Cx. univittatus*.

1.3. The status of vector-borne diseases

Currently, no records are available concerning endemic cases of mosquito-borne diseases in the state of Qatar, and all human cases have been recorded from the expatriate workers and travelers who visited the endemic countries. All published reports and articles are focused mainly on imported malaria cases[3,4]. It is worth mentioning that the World Health Organization has reported in 1990 that Qatar is a malaria-free state[5]. However, the recent survey by Mikhail *et al.*[2] has pointed out the presence of *Anopheles* spp. which could change the situation of malaria to a vulnerable status. In addition, the raise of the culicid types is also the vulnerability status because they are representing potential vectors for many diseases as well, especially in adjacent countries[6-8].

2. Materials and methods

2.1. The study area

The present survey was conducted in Al Khor district which is situated in the north-eastern part of Qatar (Figure 1). Five localities were scanned for larval collection: Al Khor City, Al Dhakira and Ras Laffan which are coastal areas and Simsimah and Al Ghuwariyah which are rural areas (Figure 2).

2.2. Collection of mosquito larvae

The current survey was conducted for two successive years from September 2009 to June 2011. Collection was carried out from the most expected breeding sites as present in nature. A field trip was performed biweekly except the extreme summer and winter months (August and January respectively). The larvae

were collected by a standard dipper (about 300 mL each), and five dips were taken from each site. The collected larvae were fixed in 70% ethyl alcohol, labeled and stored in glass bottles for lab identification. Larvae were identified by using the standard identification keys[9-12]. Some larvae were kept alive and allowed to raise up in the lab to obtain the adult stages, especially those related to *Cx. pipiens* complex.



Figure 1. A map of the state of Qatar showing the north-eastern district.

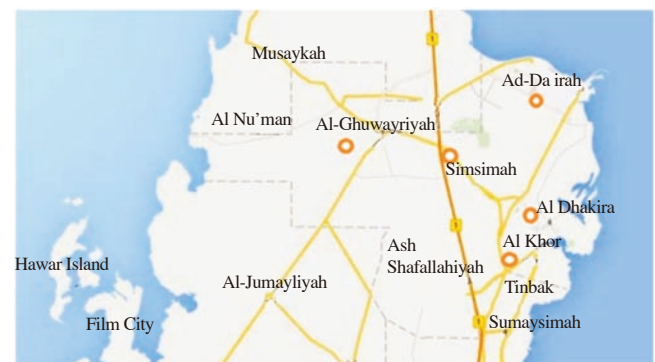


Figure 2. A map showing the main five areas of mosquito larvae collection.

The breeding sites were highly variable ranging from temporal to permanent sites. Rain landfills, irrigation ditches and landfill depressions around coastal margins were of temporal types. The permanent areas were represented by drainage ditches around animal husbandry facilities, irrigation ditches, small ponds, treatment plants and wastewater wetlands. Ditches around the animal husbandry facilities had nutrient-rich water marked by the presence of dense areas of green algae, which provided a good habitat for the breeding of mosquito larvae.

3. Results

A total of 9742 mosquito larvae have been collected from the five surveyed localities in Al Khor district of north-eastern of Qatar (Figure 3). The survey revealed the presence of 10 species of mosquito larvae, and five of them are newly recorded in Qatar. The encountered larvae species were: *Ochlerotatus caspius* (Pallas 1771) (*Oc. caspius*), *An. stephensi*, *Culex quinquefasciatus* (Say 1823) (*Cx. quinquefasciatus*), *Culex pipiens* biotype molestus (Forsk. 1775) (*Cx. pipiens* biotype molestus), *Cx. univittatus*, *Cx. pusillus*, *Culex tritaeniorhynchus* (Giles 1901) (*Cx. tritaeniorhynchus*), *Culex laticinctus* (Edwards 1913) (*Cx. laticinctus*), *Culex sitiens* (Weidmann 1828) (*Cx. sitiens*) and *Culex perexiguus* (Theobald 1901) (*Cx. perexiguus*) (Table 1).

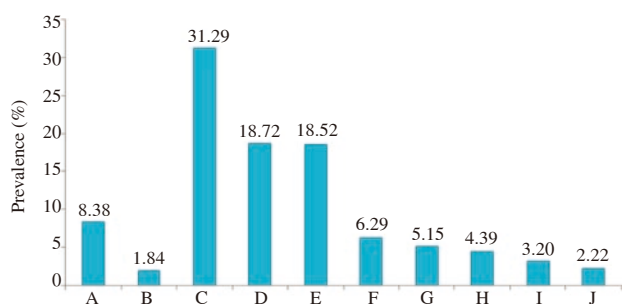


Figure 3. Prevalence of mosquito larvae collected from Al Khor district, North-eastern Qatar in 2009-2011.

A: *Oc. caspius*; B: *An. stephensi*; C: *Cx. pipiens* molestus; D: *Cx. pusillus*; E: *Cx. quinquefasciatus*; F: *Cx. univittatus*; G: *Cx. sitiens*; H: *Cx. laticinctus*; I: *Cx. perexiguus*; J: *Cx. tritaeniorhynchus*.

Cx. pipiens biotype molestus and *Cx. univittatus* were the only species which had previously been recorded from the area under study. *Oc. caspius* and *Cx. pusillus* were recorded for the first time in the area. The five species: *Cx. quinquefasciatus*, *Cx. tritaeniorhynchus*, *Cx. laticinctus*, *Cx. sitiens* and *Cx. perexiguus* were recorded for the first time in Qatar.

Table 1 indicated that the most prevalent type is *Cx. pipiens* biotype molestus (31.29%) and followed by *Cx. pusillus* and *Cx. quinquefasciatus* which have relatively similar prevalences of 18.72% and 18.52% respectively.

Table 1

Abundance of mosquito larvae collected from five localities in Al-Khor district, North-eastern of Qatar, from September 2009 until June 2011.

Species	Al Khor City	Al Dhakira	Ras Laffan	Ghuayriyah	Simsimah	Total (%)
<i>Oc. caspius</i>	317	438	61	0	0	816 (8.38%)
<i>An. stephensi</i>	88	0	12	55	24	179 (1.84%)
<i>Cx. pipiens</i> molestus	1028	405	971	383	262	3049 (31.29%)
<i>Cx. pusillus</i>	469	622	733	0	0	1824 (18.72%)
<i>Cx. quinquefasciatus</i> *	712	102	386	488	116	1804 (18.52%)
<i>Cx. univittatus</i>	265	156	98	58	35	612 (6.29%)
<i>Cx. sitiens</i> *	166	336	0	0	0	502 (5.15%)
<i>Cx. laticinctus</i> *	68	22	0	216	122	428 (4.39%)
<i>Cx. perexiguus</i> *	122	96	78	16	0	312 (3.20%)
<i>Cx. tritaeniorhynchus</i> *	86	0	0	110	20	216 (2.22%)
						9742 (100%)

*: New records in Qatar.

4. Discussion

Since the establishment of Ras Laffan industrial city in Al Khor district, as the most important city in the gas industry, the population has been exaggeratedly increased[13]. Consequently, the area has changed into large communities inside and around the industrial area especially in Al Khor City. Thus far, there have been no reports about the impact of the vector mosquitoes in this area which inspired the current survey.

Ten species of mosquito larvae have been identified and recorded from Al Khor district, and five of them were found as new records in Qatar. *Cx. pipiens* biotype molestus was the most dominant species (31.29%) and followed by *Cx. pusillus* (18.72%) and *Cx. quinquefasciatus* (18.52%). It seems that the high prevalence of these three species is due to the abundance of wastewater wetlands and brackish shallow marches which are the ideal habitats for larvae breeding. Also, the presence of landfill brackish ponds and mangrove swamps provide the ideal habitats for mosquito larvae breeding of the halophilic species, such as *Aedes caspius*, *Cx. univittatus*, *Cx. pusillus* and *Cx. sitiens*[14].

In fact, there is no record of any endemic cases of mosquito-borne diseases in Qatar and human infections are still unknown. The findings of the current study indicated that the area has different types of culicid mosquitoes which are considered as potential vectors of different arboviruses and parasite factors. It is important to point out that in the neighboring countries especially Saudi Arabia, different types of arboviruses have been established and many endemic cases have been cited[15-18].

In this study, *Cx. pipiens* molestus and *Cx. quinquefasciatus* were the most abundant larvae and were collected from different habitats. Both species are the main vectors of West Nile virus[7,19] and filariasis[20]. *Cx. tritaeniorhynchus* has also been identified in the current study and is known as the main vector of Rift Valley fever in Saudi Arabia[21]. Sindbis virus, which is a human pathogen causing a dengue-like fever, has already been isolated from *Cx. univittatus* in the eastern region of Saudi Arabia[22]. This species has also been identified in this study and is known for its

ability to breed near coastal areas. In addition, *An. stephensi* is one of the main essential vectors of malaria in both Iran and Saudi Arabia[6,15].

At present, there is no information about human infections by arboviruses in Qatar, but due to the detection of the vector mosquitoes in the area where our investigation has been conducted, it is highly probable that this might occur in the future. The presence of disease-carrying mosquitoes and the increased in population number constitute a great health risk in the area and increase the likelihood of a disease outbreak to occur in the region. Therefore, it would be prudent to implement a surveillance program to monitor the mosquito population and avert any potential mosquito-borne diseases in Qatar.

Conflict of interest statement

I declare that I have no conflict of interest

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