International Journal of Entomology Research
ISSN: 2455-4758; Impact Factor: RJIF 5.24
Received: 10-09-2019; Accepted: 22-10-2019
www.entomologyjournals.com
Volume 4; Issue 6; November 2019; Page No. 122-125

Mosquito species composition at a selected area in eastern Tripoli, Libya

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Abstract
Mosquito pose a serious health concern for they are potential vectors of some of the most important diseases to human and animal, including, malaria, filariasis, West Nile virus and Rift Valley fever virus. A better understanding of the occurrence, abundance and distribution of mosquito species is often an important component of vector control and diseases control. This study was conducted at Souq Al- jum'aa municipality east of Tripoli district / Libya, during the period June to December 2016, 12 collection sites were selected randomly. Mosquito collections were carried out by CDC Miniature Black Light (UV) and breeding containers; to determine species composition at Souq Al- jum'aa municipality eastern Tripoli, Libya. Seven species representing three genera *Aedes, Culex, Culiseta* were *Aedes detritus, Aedes caspius, Aedes dorsalis, Culex perexiguus, Culex pipiens, Culex laticinctus* and *Culiseta longiareolate.* The dominant species was *Culex pipiens* with more than 84%. The presence of *Aedes, Culex, Culiseta* suggests the potential risk for vector-borne diseases. In this study, the results on Mosquito species may help with future planning of vector control measures. However, additional studies are recommended, to have an up-to-date list of the species present in the country.

Keywords: souq al- jum'aa, mosquito, species composition, Libya

Introduction
Mosquito (family: Culicidae) are of great important in terms of public health. They represent a greater health problem because of their potential vector of some important disease for humans and animals [1]. A part from mosquito borne pathogens, mosquitoes cause nuisances for both animals and humans [2]. There has been little publishes regarding mosquito species in Libya, studies of Libyan mosquitoes recoded 38 species [1-16] Although some species such as *Aedes aegypti, Aedes taeniorhynchoides* hasn't been recorded since 1934 [16] *Aedes albopictus* has not been yet recoded; but their recent presences in neighboring North African countries Algeria, Morocco and Tunisia [17, 18, 19] heights the risk of their potential introduction in Libya, which is a sufficient reason to establish mosquito species surveillance. To our knowledge, there is no update data available on mosquito species of Souq Al- jum'aa municipality at Tripoli district. Therefore, the aim of this current study was to determine the species composition in this municipality and to gather data so that their role as vector for various human and animal's disease may be better understood.

Materials and methods
Study area
This survey was conducted in Souq Al- jum'aa municipality, which is situated 5 km on the east of Tripoli district (32.8894 °N, 13.2419°E) at altitudes 222 m above sea level / Libya, covers an area approximately 45.17 km^2 with 259133 inhabitants [20].This municipality is generally a residential areas characterized by the available vegetation, animals, birds, marshy, beaches, sport field and Mitiga Airport. The climatological data were recorded by the nearest available climate station to the geographical location. The average temperature in Souq Al- jum'aa municipality was 23.9c°, the average rainfall was 25.6 mm and 63.7% average relative humidity recorded during the study period 2016 [21] Figure 1.

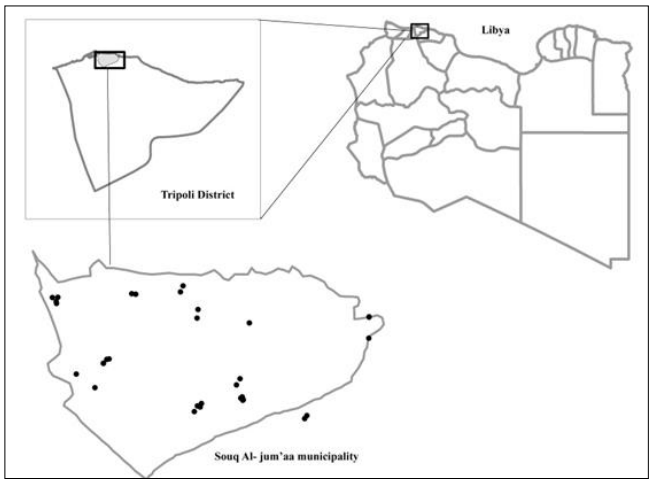

Fig 1: Map of collection localities of the study area

Mosquito collection
Mosquito survey were carried out at twelve sites from June to December in year 2016, collection were performed once every 2 weeks at each area. Mosquito were collected overnight, covering sunset and sunrise period, with 15 CDC Miniature Black Light (UV) Trap Model 1212 (John W.Hock Company®), the traps were set at the same

collection sites throughout the study period, these sites were namely Arada Rd 1, Arada Rd 2, 16 Road, Alhany Rd, 20 Ramadan Rd/ 11 June Rd, Terracena, Alshat, Mitiga International Airport, Mitiga base, Talpagh, Warima, Abusitta Horse Racing, also mosquito larvae were collected and rear to imago stage to asset the adult collection [22]. The emerged adult were collected and preserved in plastic vials, all mosquito specimens were refrigerated 4c° and then transferred to the parasitology and vector borne diseases laboratory at the National Center for Disease Control (NCDC), were they were identified to species with identification software an offline keys, MosKeyTool: an interactive identification key for mosquitoes of Euro-Mediterranean [23].

Results

During the study period 7 adults of mosquito species were collected from Souq Al- jum'aa municipality at Tripoli district. Notably (*Aedes detritus, Aedes caspius, Aedes dorsalis, Culex perexiguus, Culex pipiens, Culiseta longiareolate and Culex laticinctus*). The encountered species were belonging to 3 genera, namely; Culex 96% (3 species); Aedes 3.3% (3 species) and Culiseta 1.5% (one species).(Table 1).

Table 1: Total No. of mosquito species collected during the survey at Souq Al - Jum'aa Municipality / Tripoli

Species	No. Collected
Aedes caspius	16
Aedes dorsalis	5
Aedes detritus	4
Culex laticinctus	14
Culex perexiguus	74
Culex pipiens	634
Culiseta longiareolate	11
Total	758

Composition and localities of the mosquito collected in this survey are shown in (Table 2). The highest numbers of mosquitoes were collected in Arada Rd, Talpagh 260, 120, respectively and the lowest were collected in Terracena, Mitiga Airport 23, 23 respectively.

Table 2: Composition and localities of the mosquito collected from Souq Al - Jum'aa Municipality / Tripoli

	Code	Site	Jun 2016	Jul 2016	Aug 2016	Sept 2016	Oct 2016	Nov 2016	Dec 2016	Total
Arada Rd 1	Ara 1	Site 1	15	42	32	26	64	61	20	260
Arada Rd 2	Ara 2	Site 2	6	2	6	16	8	13	11	62
16 Road	Rd 16	Site 3	2	1	2	4	5	4	9	27
Alhany Rd	Alh Rd	Site 4	4	1	1	2	11	9	10	38
20 Ramadan Rd/ 11 June Rd	20 Rd/ 11 June	Site 5	0	1	8	11	11	5	2	38
Terracena	Terr	Site 6	0	0	2	2	9	4	6	23
Alshat	Alsh	Site 7	4	2	8	1	12	3	7	37
Mitiga International Airport	MIA	Site 8	1	1	7	5	2	4	3	23
Mitiga base	MB	Site 9	3	3	5	8	4	3	5	31
Talpagh	Talp	Site 10	12	28	15	56	6	1	2	120
Warima	Wari	Site 11	5	3	3	34	2	2	2	51
Abusitta Horse Racing	ABHR	Site 12	4	4	6	13	10	8	3	48
Total			56	88	95	178	144	117	80	758

Monthly variations in species composition of mosquitoes were the highest collected on October 144 and the lowest 56 on June (Table 3). Moreover, there were no significant differences associated mosquito population with temperature, relative humidity and rainfall ($p > 0.05$).

Table 3: Monthly variations of different species of mosquito population during the survey at Souq Al- Jum'aa Muicipality / Tripoli

Months	*Ae. caspius*	*Ae. dorsalis*	*Ae. detritus*	*Cx. laticinctus*	*Cx. perexiguus*	*Cx. pipiens*	*Cs. longiareolate*
Jun, 2016	0	0	0	1	2	53	0
Jul, 2016	0	0	0	3	10	74	1
Aug, 2016	0	0	0	0	11	84	0
Sep, 2016	0	0	0	1	11	163	3
Oct, 2016	16	5	4	1	17	96	5
Nov, 2016	0	0	0	2	13	100	2
Dec, 2016	0	0	0	6	10	64	0

Discussion and Conclusion

Mosquito survey show the abundance of various species present at any given time such surveys is necessary to evaluate mosquito born pathogen incidence in a community, sampling efficacy differs according to trap type, trapping with only type of trap does not accurately represent the mosquito fauna of individual study areas. Although, in this study CDC Miniature Black Light (UV) and breeding containers; were used, consequently this may have biases with mosquito species capture. Moreover, the mosquitoes were operated overnight, covering sunset and sunrise periods, and some species that tend to be diurnally active, namely aedines, may have been misrepresented [24,25,26]. Over all, the current result in shown percentage among the genera Aedes, Culex, Culiseta were 96%, 3.3% and 1.5% respectively. In genus Culex, Culex perexiguus, Culex pipiens, was found abundantly throughout the study period from June to December; our study was similar to [27, 28, 29]. The next prevalent species found was *Culex laticinctus, Culiseta longiareolata*, however, less prevalent mosquito species were recorded *Aedes detritus*, *Aedes caspius* and *Aedes dorsalis* during October month; these results are consistent to [29, 31, 32]. This study showed that the Culex species distributed in a broad range of habitat preference

than the other genera. While, Aedes species were found from a few habitats and was the least diverse. The mosquito composition in the residential area was vastly different to the other sites in this study. This suggests that there is a different diversity and composition of mosquitoes across different land used area types. It was found that Arada road and Talpagh was the most preferred site for mosquitoes. As there was no huge difference in plants, animals and birds in all the 12 collection sites. But these sites Arada road and Talpagh had containing stagnant waters, such as flood plains, poorly drained, ditches, etc... Certain species prefer temporary environments (rainfall dependant); the current results are consistent to those as described in literature [33 - 37]. It was found in current study that mosquito composition were abundant at Arada Rd 1, 16 Road, and Talpagh respectively. The current places that were mentioned had much leaf litter, organic matter and used tires and wetland in the rainy season which potentially caused high species richness and diversity and provide a perennial source of breeding place for these mosquitos. The gravid female is predicted to oviposit in a breeding site that will maximize the offspring fitness; suggesting thereby, the adult mosquitoes will oviposit in sites with high shade and leaves [34, 35]. Therefore, it could be speculated that a higher abundance of mosquito adults might be correlated with high shade and leaves in the sites observed (Arada Rd 1, 16 Road, Alhany Rd and Talpagh). The current findings are in accordance and hence, consistent with the results already published [33, 34]. In general, insects are exceedingly sensitive to temperature, relative humidity and rainfall regiments and frequently show great variations in seasonal abundance [34, 38]. In this study there were no significant differences associated between mosquito population with temperature, relative humidity and rainfall ($p > 0.05$). This could suggest that a particular species found favor environment conditions and habitat that allow species to dominate and thrive.

Conclusively, In this study, some potential vectors of medical and veterinary importance such as *Aedes detritus, Aedes caspius, Aedes dorsalis, Culex perexiguus, Culex pipiens, Culiseta longiareolate* were identified. These species are known vectors already identified in many regions in the world, further studies on mosquito composition are needed in the remaining unexplored area and virus isolation are needed to identify arborviruses that are circulating in the area. Such information will be valuable in controlling potential outbreak of arbovirus disease in this country.

Conflict of interest

The authors declare no conflicts of interest. The authors alone are responsible for the content and writing of this article.

Acknowledgments

We are grateful to the members who help out in collecting mosquito samples. This work was supported by Parasitology and Vector Borne diseases Laboratory and the National Center for Diseases Control – Ministry of health Tripoli / Libya, the assist of Souq Al jum'aa municipality Tripoli, district/ Libya and Medlab secure; medical entomology group (Vincent Robert) (IRD), and Gilbert Le Goff (IRD) French National Research institute for sustainable development for their grateful help and assistants.

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