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Ultraviolet Light Traps in Reducing Mosquito Populations in the Qasr Ben Ghashir area

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مصائد الأشعة فوق البنفسجية في الحد من أعداد البعوض في منطقة قصر بن غشير

الملخص:

المصائد الضوئية الفوق بنفسجية تعتبر وسيلة فعالة في مكافحة البعوض، حيث تجذب الحشرات باستخدام الضوء الفوق بنفسجي. يتم اصطياد البعوض باستخدام شبكات كهربائية بعد تجمعها حول المصدر الضوئي. تهدف الدراسة إلى تقييم تأثير هذه المصائد في تقليل أعداد البعوض في المناطق المتأثرة بانتشار الحشرات الناقلة للأمراض مثل الملاريا وحمى الضنك. أظهرت النتائج أن المصائد ساهمت بشكل كبير في تقليل أعداد البعوض في الأماكن التي تم تركيبها فيها مقارنة بالمناطق الأخرى.

الكلمات المفتاحية: *مصائد الأشعة فوق البنفسجية، مكافحة البعوض، جذب الحشرات، الملاريا، حمى الضنك.*

Abstract:

Ultraviolet (UV) light traps are an effective method for mosquito control, as they attract insects using UV light. Mosquitoes are captured using electric grids after gathering around the light source. The study aims to evaluate the impact of these traps on reducing mosquito populations in areas affected by the spread of disease-carrying insects, such as malaria and dengue fever. The results showed that the traps significantly contributed to reducing mosquito numbers in areas where they were installed compared to other areas.

Keywords: *UV traps, Mosquito control, Insect attraction, Malaria, Dengue fever.*

Introduction:

Medical entomology is a significant branch that studies the relationship between insects and the health issues they cause for humans and animals. It focuses on understanding the mechanisms of disease transmission and methods for controlling and eliminating disease-carrying insects. Due to the critical impact of medical insects on human health, scientists have studied these creatures from various perspectives. Some insects from the Diptera order are considered among the most dangerous medical insects as they serve as vectors for pathogens such as parasites, bacteria, rickettsia, and viruses. Mosquitoes, in particular, are well-known medical insects. Their annoying bites and role in transmitting deadly pathogens make them extremely important. The mosquito family is one of the most significant families within the Diptera order.

Mosquitoes can colonize a wide variety of aquatic habitats, including ponds, swamps, riverbanks, saltwater marshes, polluted water in sewage basins, rock pools, tree holes, discarded household containers, discarded tires, and rice fields.

Mosquitoes are among the most significant disease vectors, known for transmitting pathogens that cause global tropical diseases in humans and animals (Weaver and Reisen, 2010) Diseases transmitted by mosquitoes are a major public health and global safety concern, with approximately 700 million people infected annually and over one million

deaths. These include infections such as Zika virus, malaria, dengue fever, chikungunya virus, West Nile virus, as well as Eastern equine encephalitis, Western equine encephalitis, and St. Louis encephalitis (WHO, 2014).

Based on evidence, it is estimated that mosquitoes may have originated in the early Paleogene period about 70 million years ago, or even earlier (Harbach, 2015) Mosquitoes have a wide distribution, and there is no part of the world inhabited by humans where mosquitoes are absent. They are found throughout temperate and tropical regions and extend as far north as the Arctic Circle. Many species even inhabit remote deserts. Due to their presence in a wide range of aquatic and terrestrial environments, mosquitoes exhibit various morphological and behavioral adaptations (Becker et al, 2010).

Climate change and rising global temperatures are leading to the introduction and spread of mosquito species into new regions, countries, and even continents. Additionally, global trade and travel have facilitated the spread of non-native species worldwide (Keller, 2011). Therefore, identifying mosquito species is crucial to determine those that transmit pathogens and to develop effective control programs.

There are approximately 3,500 mosquito species worldwide, of which about 100 species are human disease vectors. Mosquitoes alone account for around 380 species globally, with 60 species transmitting malaria. Additionally, certain aggressive mosquito species transmit filariasis and viral diseases. Mosquitoes found in swampy areas, particularly some species in southern India, Indonesia, Malaysia, and other regions, also play a significant role (WHO, 2011).

Importance of the Research:

Due to the medical and veterinary importance of the common mosquito, and in line with the recommendations of various international and local meetings on biodiversity protection, and considering the rarity of taxonomic studies on the common mosquito species *Culex spp.* in Libya, this research aims to lay a foundational stone in building biodiversity in Libya.

Due to environmental changes resulting from various human activities, such as sewage, industrial wastewater, and other pollutants, new ecological patterns have emerged, affecting the distribution of mosquito species in the region. Therefore, our study on the classification of mosquito larvae species from the genus *Culex spp.* comes as a result of the awareness of the medical and veterinary importance of this genus, after a long period of absence, and aims to contribute to enriching the biodiversity map of Libya.

Research Objectives:

This research focused on studying the following aspects:

A. The presence of mosquitoes during the summer in the Qasr Bin Ghashir area (Libya).

B. The variation in mosquito presence between different areas in the city of Qasr Bin Ghashir (Libya).

C. The effectiveness of ultraviolet light traps.

Taxonomic Classification of the Common Mosquito:

The common mosquito is classified according to the globally recognized classifications by (Harbach, 1985; Harbach, 1988; Huang, 2001; Mehlhorn et al., 2008) as follows:

Kingdom:	Animal
Phylum:	Arthropoda
Sub Phylum:	Uniramia
Super Class:	Hexapoda
Class:	Insecta
Sub Class:	Pterygota
Division:	Endopterygota
Order:	Diptera
Sub Order:	Nematocera
Family:	Culicidae
Sub Family:	Culicinae
Genus:	*Culex*

Cx. pipiens Linnaeus, 1758.
Cx. quinquefasiatus Say, 1823. *Cx. vagans* Wiedemann, 1828.
Cx. *torrentium* Martini, 1925
Cx. theileri Theobald, 1903a. Cx. *tritaeniorhynchus* Giles,1901a.
It is internationally agreed to abbreviate the genus name *Culex* as "Cx," while the subgenus name *Culex* is abbreviated as "Cux." The letter "C" is also used to abbreviate the genus *Culiseta*, which belongs to the same family, *Culicidae*.

Research Methods:

Study Location:

The current study was conducted in the city of Qasr Bin Ghashir, where five sites were selected in this city: (Bir Al-Tutta, Mabrouk Haman, Al-Sharif Hotel, Ar-Ramlah, and Kazirma).

Mosquito Collection Period:

The adult mosquitoes were collected from June to September 2023, with collections made once every ten days at each of the study sites mentioned.

Method Used for Mosquito Collection:

There are many methods for mosquito collection, and in this study, the light trap method was chosen for collecting mosquitoes.

- **Light Trap:**

Light traps are one of the most common and widely used insect traps in environmental studies, suitable for nocturnal insects that are attracted to light. The light trap used in this

study consisted of ultraviolet light. These traps were operated at each site from sunset until the following morning, and the insects that fell into the collection bottle were gathered.

Figure (1): Ultraviolet light trap with a fan.

Preservation of Insects:

The collected mosquitoes were preserved in small, tightly sealed tubes containing 70% ethanol, with a few drops of pure glycerin oil added to prevent the samples from drying out and to maintain a clear and transparent appearance. The samples were stored for a short period to prevent decomposition or damage. Each tube was labeled externally with details including the number of mosquitoes, collection date, and location.

Figure (2): Method of preserving samples for identification.

Results and Discussion:

Table (1): Number of mosquitoes captured in the Bir Al-Tutta area.

Number of Collection Attempts	Date	Number of Mosquitoes Captured
1	05/07/2023	5
2	19/07/2023	12
3	02/08/2023	12
4	16/08/2023	6
5	30/08/2023	4
6	13/09/2023	27
7	27/09/2023	38
Total Number of Mosquitoes Captured		**104**

From the table, it was observed that mosquitoes were present throughout the study period, with the highest number of mosquitoes captured on September27 and the lowest on August30.

Table (2): Number of mosquitoes captured in the Mabrouk Haman area.

Number of Collection Attempts	Date	Number of Mosquitoes Captured
1	05/07/2023	2
2	19/07/2023	5
3	02/08/2023	1
4	16/08/2023	3
5	30/08/2023	20
6	13/09/2023	15
7	27/09/2023	1
Total Number of Mosquitoes Captured		**47**

From the table, it was observed that mosquitoes were present throughout the study period, with the highest number of mosquitoes captured on August30 and the lowest on August2 and September27.

Table (3): Number of mosquitoes captured in the Al-Sharif Hotel area.

Number of Collection Attempts	Date	Number of Mosquitoes Captured
1	05/07/2023	0
2	19/07/2023	3
3	02/08/2023	7
4	16/08/2023	15
5	30/08/2023	20
6	13/09/2023	2
7	27/09/2023	10
Total Number of Mosquitoes Captured		**57**

From the table, it was observed that mosquitoes were present starting from July5, with the highest number of mosquitoes captured on August30 and the lowest on July5.

Table (4): Number of mosquitoes captured in the Ar-Ramlah area.

Number of Collection Attempts	Date	Number of Mosquitoes Captured
1	05/07/2023	20
2	19/07/2023	5
3	02/08/2023	5
4	16/08/2023	5
5	30/08/2023	1
6	13/09/2023	1
7	27/09/2023	2
Total Number of Mosquitoes Captured		**39**

From the table, it was observed that mosquitoes were present throughout the study period, with the highest number of mosquitoes captured on July5 and the lowest on August30 and September13.

Table (5): Number of mosquitoes captured in the Kazirma area.

Number of Collection Attempts	Date	Number of Mosquitoes Captured
1	05/07/2023	0
2	19/07/2023	2
3	02/08/2023	0
4	16/08/2023	4
5	30/08/2023	3
6	13/09/2023	1
7	27/09/2023	1
Total Number of Mosquitoes Captured		**11**

From the table, it was observed that mosquitoes were present starting from July5, with the highest number of mosquitoes captured on August16. They were completely absent on both July5 and August2.

Table (6): Total Number of Mosquitoes Captured in Five Study Sites.

Date	Bir Al-Tutta	Mabrouk Haman	Al-Sharif Hotel	Ar-Ramlah	Kazirma	Total
5/7/2023	5	2	0	20	0	27
19/7/2023	12	5	3	5	2	27
2/8/2023	12	1	7	5	0	54
16/8/2023	6	3	15	5	4	33
30/8/2023	4	20	20	1	3	48
13/9/2023	27	15	2	1	1	46
27/9/2023	38	1	10	2	1	52
Total	104	47	57	39	11	258

Locations: The table represents activity data across five locations: **Bir Al-Tutta**, **Mabrouk Haman**, **Al-Sharif Hotel**, **Ar-Ramlah**, and **Kazirma**.
Date Range: The data spans from July5, 2023, to September27, 2023.
Total Activity: The cumulative total across all dates and locations is 258.
Location Breakdown:
- **Bir Al-Tutta** had the highest overall activity with a total of 104, with a peak on September 27 (38).
- **Al-Sharif Hotel** recorded 57 in total, peaking on August 2 (15).
- **Mabrouk Haman** reached a total of 47, with its peak on August 30 (20).
- **Ar-Ramlah** contributed 39, with its highest value of 20 on July 5.
- **Kazirma** had the lowest total activity (11), with its highest value of 4 on August16.

Trends: Activity generally peaked in August and early September, with a noticeable decline in numbers towards late September.

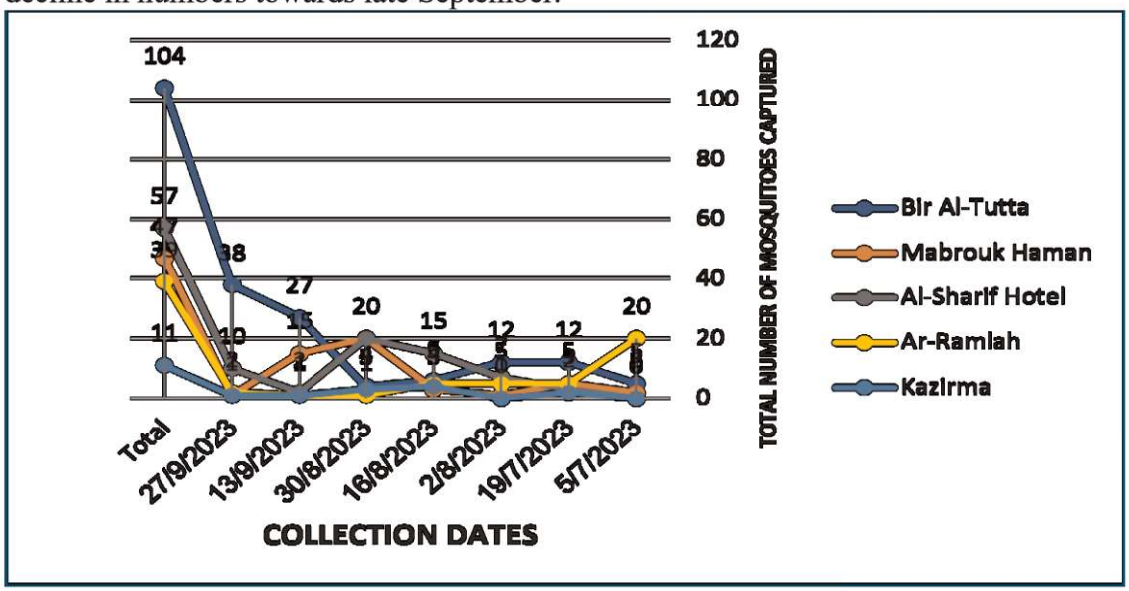

Figure (3): Distribution of captured mosquitoes according to study periods for all sites. From the graph, it is evident that the distribution of mosquitoes shows a fluctuating seasonal pattern during the study period, varying by location and collection date.

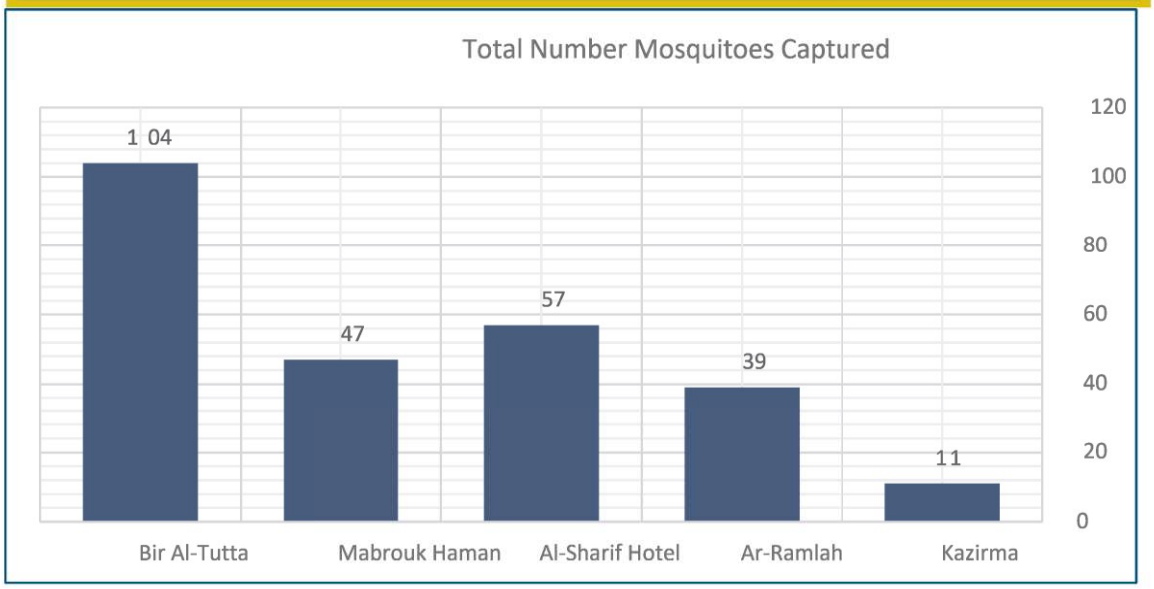

Figure (4): Total number of mosquitoes captured in the study areas.

The results indicated that during the study period, the highest mosquito density was observed in the Bir Al-Tutta area, with 104 mosquitoes captured. This was followed by Al-Sharif Hotel (57 mosquitoes), Mabrouk Haman (47 mosquitoes), Ar-Ramlah (39 mosquitoes), and Kazirma (11 mosquitoes), respectively.

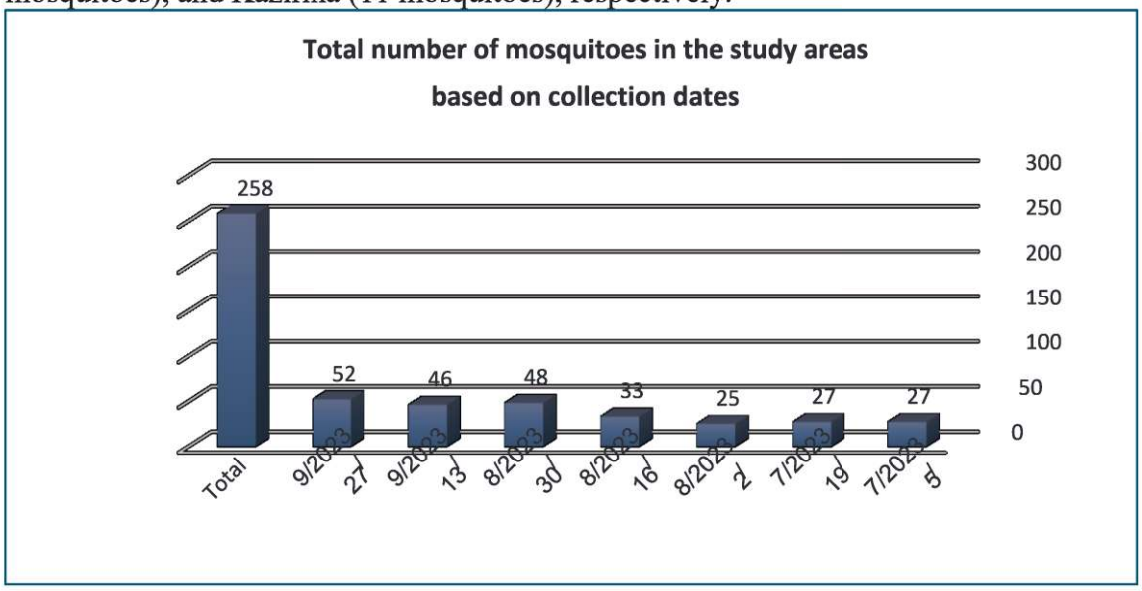

Figure (5): Total number of mosquitoes in the study areas based on collection dates.

The study revealed that the highest mosquito density across all study areas occurred on 27/9, followed by 30/8, 13/9, 16/8, and (5/7, 19/7), with the lowest density on 02/8. The numerical density of mosquitoes captured was 48, 46, 33, (27, 27), and 25 mosquitoes, respectively.

Recommendations:

1. Expanding the Use of UV Light Traps: It is recommended to deploy UV light traps more extensively in mosquito-infested areas, especially in urban and rural locations with abundant stagnant water and swamps that serve as fertile mosquito breeding grounds.

2. Integration with Other Methods: UV light traps can be combined with other mosquito control techniques, such as insecticides or protective nets, to prevent mosquito proliferation in enclosed areas.

3. Community Awareness and Training: Raising public awareness about the importance of this technology and training communities on its effective use in homes and public spaces is essential.

4. Research and Development: Further studies are recommended to improve trap designs and identify mosquito species most attracted to these traps in different environments.

5. Regular Maintenance: Periodic maintenance of the traps is necessary to ensure their effectiveness and longevity in attracting and reducing mosquito populations.

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