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Environmental And Taxonomic Study Of Mosquitoes In Al-Dywaniyah Governorate

Hanaa Rahman Lefta

Department of Biology , College of Science, University Al-Qadisiyah , Iraq, hanaa.rahman@qu.edu.iq

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Environmental and Taxonomic study of Mosquitoes in Al- Dywaniyah Governorate

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| <p>Authors Names a. Hanaa Rahman Lefta</p> <p>Article History Received on: 11/9/2021 Revised on: 1/10/2021 Accepted on: 7/10/2021</p> <p>Keywords: <i>Anopheles, Culex, Aedes, Culicidae</i> taxonomy</p> <p>DOI: https://doi.org/10.29350/jops.2021.26.5.1448</p> | <p>ABSTRACT</p> <p>The current study included the collection and classification of mosquitoes and the identification of some species because of their medical and veterinary importance in terms of their harmful effect on health and their transmission of diseases. Three species of mosquitoes were diagnosed in the different study sites, namely <i>Anopheles</i>, <i>Culex</i> and <i>Aedes</i>, where five types of <i>Anopheles</i> and four species of <i>Culex</i> were recorded. As for the third genus, two species of it were recorded, and the proportions of the species collected from the study sites varied among themselves, as the percentages varied according to the day night the different seasons of the year, and the temperature had a role in this disparity of adults mosquitoes .</p> |
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1-Introduction:

Taxonomy is the basis on which all life sciences are based. When searching for any living organism, whether it is an animal or a plant, it must determine its exact location in the world classification tree based on accurate classification keys. Insects occupied a prominent position in the classification ladder because of their huge numbers and great diversity. It made taxonomists race to study them in all respects, Among these insects are mosquitoes belonging to the Diptera family Culicidae, which includes a group that transmits many pathogens, including viral and parasitic, whose species spread in different environments and thermal regions in different parts of the world ^[16], including Mosquitoes are about 3500 species, the largest number remaining to be discovered in habitat rain forest, but less well surveyed in temperate region.

The most important species found in the world and Iraq for their medical importance are the genus *Anopheles*, which is a vector of malaria ^[15], there are approximately 350 species of *Anopheles* throughout the world *Culex*, which transmits filaria worms causative of human filariasis, and the genus *Aedes*, which plays an important role in transmitting many pathogenic viruses such as the dengue virus and yellow fever virus, mosquitoes transmit diseases to about 700 million persons ^[9], the key to mosquitoes worldwide were provided by ^[13]. The aim of the study is to identify the types of mosquitoes isolated in Al- Diwaniyah, and study the effect of temperature on adult mortality.

2 -The method of work:

2 -1 : Study sites

The study was conducted in the city of Al-Diwaniyah. Mosquito sample collection sites were selected, which are the homes of citizens by 10 houses in the countryside and the city, and animal houses and plant areas from different areas in the city, namely Daghara and Sunni districts, Hamza district, Afak, Shamiya district, Euphrates district, Umm al-Khail, Albu Saleh district and Zabid village.

Adult mosquitoes were collected for a period of 1/6/2020 at a rate of once every two weeks in each of the study sites.

2 - 2: Methods of collecting insects:

Adults were collected using A: Aspirators is an easy way to collect adults in rest areas and in animal pens.

And the use of Light Trap: B, which is the most common type of insect collection. It consists of a wooden box with a small electric lamp installed on one side, and a conical funnel is attached to the upper side. A tube enters the cavity of the box through a hole to end in an insect collection bottle. The insects were collected and then transferred to the laboratory. Department of Life Sciences and insects were preserved.

2-3 Insect specimen preparation

Some samples were temporarily carried on the slide for the purpose of diagnosis. The samples were washed with distilled water, then placed in 70% ethanol for 5 minutes, then placed on the slide and fixed using Gum Canada Balsam and the cover slide was placed at an angle. The samples were left to dry to be ready for test, and for the purpose of classifying insects the samples were examined. under the microscope and was defined using the taxonomic keys ^[3].

2 -4: Effect of temperature on adults mosquitoes

40 adult mosquitoes were selected with three replicates for each of the studied mosquito species and were placed in cages for breeding mosquitoes. Four different temperatures were used (16, 20, 25, 30) °C ,The mortality rate of insects at different temperatures was calculated every 168 hours, the values of mortality were corrected according to the equation^[1].

2-5: Statistical analysis :

All data were expressed as the average . Differences in average values were analyzed by one –way ANOVA with LSD, and difference in percentage values were analyzed by chi- square test using IBM SPSS statistics 27software (International Business Machines Crop) . Values with $P < 0.05$ were considered to indicate statically significance .

3: Results and Discussion:

The results of the study showed that there are five species of *Anopheles* mosquitoes, *An. stephensi* , *An. pulcherimus*, *An.superpictus* , *An. maculipennis* , *An. sacharovi* and four species of *Culex* mosquitoes are *Cx. quinquefasciatus*, *Cx. pipiens* , *Cx. molestus*, *Cx. deserticola* and two species of *Aedes* mosquitoes, *Ae. aegypti*, *Ae. albopictus* and a table was drawn up (1) for the types of mosquitoes isolated that were collected from different areas of Al-Diwaniyah city, from residential houses in the countryside and the city, from animal houses and plant areas. ^[4] and ^[10] showed a variation in the geographical distribution of mosquito species in Iraq, as four species of *Anopheles* and *Culex* mosquitoes were isolated *Cx.pipiens* ,This result agree with ^[7] isolation of 12 mosquitoes species belonging to five genus : *Anopheles*, *Culex* , *Aedes* , *Mansonia* and *Toxorhynchites* in Bangladesh from 14 different habitats .

Table (1) Species of isolated mosquitoes

| Genus | Species |
|------------------|---------------------------------|
| <i>Anopheles</i> | <i>An. stephensi</i> Liston |
| | <i>An. pulcherimus</i> Theobald |
| | <i>An. superpictus</i> |
| | <i>An. maculipennis</i> |
| | <i>An. sacharovi</i> |
| <i>Culex</i> | <i>Cx. quinquefasciatus</i> Say |
| | <i>Cx. pipiens</i> Linnaus |
| | <i>Cx. molestus</i> Forskal |
| | <i>Cx. deserticola</i> |
| <i>Aedes</i> | <i>Ae. aegypti</i> |
| | <i>Ae. albopictus</i> |

Mosquito species were classified and placed in Table (2), which showed a discrepancy in the number of mosquitoes isolated in relation to the genus *Anopheles stephensi* and *An. pulcherimus*, the highest presence (849,722) for the two species, respectively, while small numbers of *An. superpictus*, *An. maculipennis* and *An. sacharovi* (113, 140, 97) , the static analysis showed that there were significant differences between the appearance of the species according the location . Respectively, and this agrees with what ^[2] mentioned to the existence of the two species *An. stephensi* and *An. pulcherimus* in abundance in central Iraq, and they are a major vector of malaria in central Iraq. The total number of it (1225, 1155, 658, 284) for species *Cx. quinquefasciatus*, *Cx. pipiens* , *Cx. molestus*, *Cx. deserticola* ,the presence record of *Aedes* mosquitoes are *Ae. aegypti* and *Ae. albopictus*, with a total of (203, 51), respectively, collected by (13,268) *Anopheles* mosquitoes When collecting mosquitoes , varying percentages of mosquitoes were observed . The reason may be due to the ability of mosquitoes to grow and reproduce in different environments and live in different environmental conditional that differ from region to another ^[18] . ^[11] is noted that the highest occurrence of isolated mosquito species was in the rural areas more than the urban area, due to the availability of suitable environmental conditions in the rural for the breeding and flight of mosquitoes . Except for the species *Cx. quinquefasciatus* is more in the urban than in the rural because he is a type of human being , either species *Cx. pipiens* is found in city because it is a non-human-loving species and this is consistent with ^[2] and the presence of two types of *Aedes* mosquitoes less compared to the rest of the mosquitoes, where this species of mosquitoes abound in the southern regions compared with the middle Euphrates regions such as Diwaniyah and Babylon , ^[11] and ^[10] made a taxonomic and ecological study for all types of mosquitoes, the results of the current study are in agreement with the finding ^[12] and ^[19] successfully applied for classification species of mosquitoes recorded in Iraq .

Table (2) Shows the location of adults mosquitoes

| Genus | Species | Collecting site | | | | Total | LSD _{0.05} |
|------------------|----------------------------|-----------------|-------|--------------|-------------|-------|---------------------|
| | | Urban | Rural | Animal house | Plants area | | |
| <i>Anopheles</i> | <i>An. stephensi</i> | 130 | 296 | 233 | 190 | 849 | 3.128 |
| | <i>An.pulcherimus</i> | 100 | 280 | 213 | 176 | 722 | 6.14 |
| | <i>An. superpictus</i> | 13 | 35 | 27 | 38 | 113 | 2.18 |
| | <i>An.maculipennis</i> | 15 | 48 | 32 | 45 | 140 | 4.65 |
| | <i>An. sacharovi</i> | 18 | 20 | 25 | 34 | 97 | 3.551 |
| <i>Culex</i> | <i>Cx.quinquefasciatus</i> | 450 | 250 | 290 | 235 | 1225 | 8.104 |
| | <i>Cx. pipiens</i> | 170 | 485 | 285 | 215 | 1155 | 14.78 |
| | <i>Cx. molestus</i> | 145 | 300 | 63 | 150 | 658 | 11.08 |
| | <i>Cx. deserticola</i> | 40 | 125 | 71 | 48 | 284 | 8.072 |
| <i>Aedes</i> | <i>Ae. aegypti</i> | 20 | 90 | 23 | 70 | 203 | 5.905 |
| | <i>Ae. albopictus</i> | 7 | 16 | 7 | 22 | 51 | 3.016 |

| | | | | | | | |
|---------------------|--|-------|--------|--------|-------|--------|--------|
| Total | | 908 | 2145 | 1269 | 1223 | 5497 | 14.124 |
| LSD _{0.05} | | 9.034 | 11.128 | 13.322 | 10.36 | 17.413 | |

Mosquito species were collected by the method of the Aspirator and the light trap, and the total number of *Anopheles* mosquitoes was higher, which amounted to (978) compared to the method of collection with the light trap, which amounted to (943), and the total for the types of *Culex* and *Aedes* during the study period by the method of collecting by the aspirator (1290, 156) respectively Using the optical trap method (2032, 98) for the two species of mosquitoes, respectively, the static analysis showed that there were significant differences between the collection methods Table (3) ,the results of study are agreement with ^[6] when the aspirator was use as a collection method inside and outside the house in Hilla city to calculate the numerical density of mosquitoes , While disagreeing with the results mentioned ^[14] that light traps are the best method to collect adults of *Anopheles* mosquitoes

Table (3) The number of Mosquitoes according to the method of collection .

| Genus | Light trap | Aspirator | Total |
|---------------------|------------|-----------|--------|
| <i>Anopheles</i> | 943 | 978 | 1921 |
| <i>Culex</i> | 2032 | 1290 | 3322 |
| <i>Aedes</i> | 98 | 156 | 1254 |
| Total | 3073 | 2424 | 5497 |
| LSD _{0.05} | 11.158 | 7.452 | 14.641 |

The highest presence of *Anopheles* species was during the day, with a total of (543, 400, 75) for species *An. stephensi*, *An. pulcherimus*, *An. superpictus*, while the highest occurrence of *An. maculpennis* and *An. sacharovi* during the night reached (80, 52) for the two species, respectively, while there was a discrepancy in the times of *Culex* species presence, as it reached the highest presence of species *Cx. quinquefasciatus* (800) during the day while it decreased to 425 at night and the highest presence (750, 458, 160) of species *Cx. pipiens*, *Cx. molestus*, *Cx. deserticola*, while *Aedes* mosquitoes recorded the highest presence in daytime (156, 40) for *Ae. aegypti*, *Ae. albopictus* respectively , the mosquitoes increased in day because of the availability energy and food , the static analysis showed that there were significant differences between the appearance of the species table (4) ,the results of the current study agreed with ^[8] showed that there is a discrepancy in the rate of appearance of some species of mosquitoes between day and night .

Table (4) Collecting time of adults mosquitoes (days / night)

| Genus | Species | Day | Night | Total |
|---------------------|-----------------------------|--------|---------|--------|
| <i>Anopheles</i> | <i>An. stephensi</i> | 543 | 306 | 849 |
| | <i>An. pulcherimus</i> | 400 | 322 | 722 |
| | <i>An. superpictus</i> | 75 | 38 | 113 |
| | <i>An. maculipennis</i> | 60 | 80 | 140 |
| | <i>An. sacharovi</i> | 45 | 52 | 97 |
| <i>Culex</i> | <i>Cx. quinquefasciatus</i> | 425 | 800 | 1225 |
| | <i>Cx. pipiens</i> | 750 | 405 | 1155 |
| | <i>Cx. molestus</i> | 458 | 200 | 658 |
| | <i>Cx. deserticola</i> | 160 | 124 | 284 |
| <i>Aedes</i> | <i>Ae. aegypti</i> | 154 | 49 | 203 |
| | <i>Ae. albopictus</i> | 40 | 11 | 51 |
| Total | | 3112 | 2116 | 5497 |
| LSD _{0.05} | | 15.125 | 11.0604 | 17.413 |

The collection methods were carried out for different mosquito species according to the seasons of the year as shown in Table (5). It was found that there are differences in the seasonal presence of isolated mosquito species. The highest presence of *An. stephensi*, *An. pulcherimus* and *An. superpictus* reached (296, 276, 65) respectively during the summer and the species *An. superpictus* in winter, either species *An. maculipennis* and *An. sacharovi* The highest occurrence of *Culex* mosquitoes was (550, 590, 180, 150) for the two species respectively, the highest occurrence of *Culex* mosquitoes was (550, 590, 180, 150) for the species *Cx. quinquefasciatus*, *Cx. pipiens*, *Cx. molestus*, *Cx. deserticola*, respectively, during the summer and in the winter was lower (60, 68, 36) for *Cx. quinquefasciatus*, *Cx. pipiens*, *Cx. molestus*, respectively, while was less visible *Cx. deserticola* in Autumn (28), as for *Aedes* mosquito, its highest appearance was (32, 173) for the two mentioned species, respectively, during the summer, while its least appearance was in the winter (3, 1) the static analysis showed that there were significant differences between the appearance of the species. The results agree with what mentioned [15] and [17] that *Anopheles* and *Aedes* species mosquitoes are more abundant in the Summer and less in the Winter.

Table (5) Seasonal presence of adults mosquitoes

| Genus | Species | Summer | Autumn | Winter | Spring | Total | LSD _{0.05} |
|---------------------|-----------------------------|--------|--------|--------|--------|--------|---------------------|
| <i>Anopheles</i> | <i>An. stephensi</i> | 269 | 300 | 53 | 200 | 849 | 4.205 |
| | <i>An. pulcherimus</i> | 276 | 200 | 56 | 190 | 722 | 7.221 |
| | <i>An. superpictus</i> | 65 | 12 | 13 | 23 | 113 | 3.214 |
| | <i>An. maculpinnis</i> | 30 | 45 | 15 | 50 | 140 | 2.092 |
| | <i>An. sacharovi</i> | 20 | 35 | 2 | 40 | 97 | 4.636 |
| <i>Culex</i> | <i>Cx. quinquefasciatus</i> | 550 | 330 | 50 | 295 | 1225 | 6.218 |
| | <i>Cx. pipiens</i> | 590 | 280 | 60 | 225 | 1155 | 9.534 |
| | <i>Cx. molestus</i> | 180 | 110 | 68 | 300 | 658 | 8.703 |
| | <i>Cx. deserticola</i> | 150 | 28 | 56 | 50 | 284 | 6.308 |
| <i>Aedes</i> | <i>Ae. aegypti</i> | 173 | 20 | 3 | 7 | 203 | 3.064 |
| | <i>Ae. albopictus</i> | 32 | 8 | 1 | 10 | 51 | 3.181 |
| Total | | 2362 | 1368 | 377 | 1390 | 5497 | 13.206 |
| LSD _{0.05} | | 7.152 | 9.311 | 9.098 | 8.246 | 17.413 | |

The effect of temperature on the survival of adults mosquito

The results showed that changes in temperature have a clear effect on the mortality rate of adult mosquitoes, The temperature effect on the number and productivity of the adults , the highest mortality of *An. stephensi* adults was (92.5) at 16 temperature , while the lowest percentage mortality was (62.5) at 30 temperature , Table(6) the static analysis showed that there were significant differences between the treatment ,The temperature of 25 °C was the best for the survival of adult and this is consistent and agreed with the findings of ^[5] when he exposed adults to mosquitoes *Cx. quinquefasciatus* and *Cx. pipiens* for different temperatures, as 24°C was the best for survival of adults, and survival rates decreased with increasing temperature.

Temperature is one of the most important environmental factors that affect biological processes and functions. It was found that adults raised at high temperatures have the ability to survive more compared to low temperatures. *Anopheles* mosquitoes found that their presence increases during the autumn and spring and decreases at high and low temperatures. As for *Culex* mosquitoes And *Aedes* was found to withstand high temperatures in the summer, and the results showed that the genus *Aedes* increases more in hot areas than in cold areas, as it withstand high temperatures compared with other species, and that the climate of Al-Diwaniyah varies in temperature, which affects the annual presence of mosquitoes .

Table (6)The effect of temperature on the survival of adults mosquitoes

| Species | Percentage Mortality in different temperature °C | | | | X ² / P value |
|-----------------------------|--|-----------------|------------------|----------|--------------------------|
| | 16 | 20 | 25 | 30 | |
| <i>An. stephensi</i> | 92.5 | 75.0 | 67.5 | 62.5 | 10.85/ .013 |
| <i>An. pulcherimus</i> | 95.0 | 85.0 | 70.0 | 60.0 | 16.63/0.001 |
| <i>An. superpictus</i> | 100 | 77.5 | 75.0 | 67.5 | 14.68 0.002 |
| <i>An. maculpinnis</i> | 87.5 | 82.5 | 77.5 | 80.0 | 1.47 /0.688 |
| <i>An. sacharovi</i> | 97.5 | 75.0 | 80.0 | 82.5 | 8.26/0.041 |
| <i>Cx. quinquefasciatus</i> | 87.5 | 70.0 | 57.5 | 47.5 | 15.82/0.001 |
| <i>Cx. pipiens</i> | 87.5 | 65.0 | 60.0 | 32.5 | 25.8 /0 |
| <i>Cx. molestus</i> | 87.5 | 80.0 | 72.5 | 70.0 | 4.3 /0.231 |
| <i>Cx. deserticola</i> | 90.0 | 85.0 | 82.5 | 92.5 | 2.28 0.515 |
| <i>Ae. aegypti</i> | 95.0 | 90.0 | 75.0 | 35.0 | 45.84 /0 |
| <i>Ae. albopictus</i> | 97.5 | 95.0 | 85.0 | 80.0 | 8.62 /0.035 |
| X ² P value | 12.97 / 0.225 | 19.06/0.0 39 | 15.41 / 0.118 | 53.99 /0 | |

Conclusion :

The entomological investigation in Al-Diwaniyah governorate proved the presence of various species of mosquitoes , including *Anopheles* , *Culex* , *Aedes* , and other species that were not classified , which have a high density during most seasons of the appropriate environment Al-Diwaniyah city of water bodies , ponds, and sewers that greatly help in the spread and reproduction of mosquitoes , which are close to humans and contribute to the transmission of most dangerous pathogens .

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