Contribution to Occurrence of the Blackfly (Diptera:Similiidae) in the Palestinian Territories, West Bank

ABSTRACT

Aims: The primary objective of the study was to gather evidence regarding the presence of black fly fauna in the Palestinian environment. The research extensively examined breeding sites and habitats, as well as studied the physiochemical parameters of the water in these breeding sites. Furthermore, the study assessed the potential impacts of these insects on both humans and animals

Study design: A cross- sectional study.

Place and Duration of Study: From January 2023 to August 2023, a cross-sectional survey was conducted in the West Bank-Salfit district to collect larvae and adult blackflies within the Wadi Qana conservation area.

Methodology: In January 2023, a field survey was conducted in the Wadi Qana protected area (32.12582, 34.8952) in the Salfit district to study the freshwater fauna. A total of 220 individual specimens were collected from the running water within the valley using forceps and preserved in 70% ethanol. Microscope slides were prepared for these specimens and examined under a light microscope, while adults of this group were examined under a dissecting microscope. The specimens were identified using various identification keys [4, 9, 10, 11, 12].

Results: During the study period, a total of 220 larvae were collected from breeding sites in the freshwater habitats of Wadi Qana. Two subgenera of blackflies were identified in the study area: *Simulium (Wilhelmia)* Enderlein and *Simulium (Odgamia)* Enderlein. The results indicate that blackflies breed in fast-flowing freshwater habitats covered by annual aquatic plants, with dissolved oxygen levels at 10.1 mg/L , pH average 8.2 and average temperature 21.6°C.

No significant health effects were recorded or documented in the study area, except for the nuisance caused to humans and animals by the biting of blackflies.

In conclusion, this study marks the first recorded presence of blackflies in the Palestinian environment. Further research is needed to explore their fauna, biology, ecology, habitats, distribution, and medical significance.

Conclusion: blackfly was recorded for the first time in the Palestinian environment, more study research are needed to discussed the fauna, biology, ecology, habitats, distribution and the medically important.

Keywords: Blackfly, Similiidae, West Bank, distribution, Palestine.

1. INTRODUCTION

Blackflies (Diptera: Simuliidae) consider a small, black ,and blood- feeding insect flies that inhabit running fresh water such as spring, river and stream [1,2]. Over 2000 species of black flies feed on vertebrate blood, and only 1.5% of all these species act as vectors for pathogens that cause diseases in humans. Among the nine diseases transmitted by simuliid flies, only two, Mansonellosis and Onchocerciasis, affect human [1,2]. Onchocerciasis is a debilitating disease infecting an estimated 40 million people in Africa, Latin America, and Yemen, whereas mansonellosis is a mild disease in the Neotropics [1]. They are known to be a nuisance to human, animals and birds, in the other hand the female flies consider a transmitter for many diseases, particularly onchocerciasis (river blindness), which is caused by the parasite Onchocerca [1,2]. Additionally, blackflies can cause painful bites, which, although not directly life-threatening, can lead to discomfort and secondary infections. Therefore, controlling and managing blackfly populations is crucial for reducing the transmission of diseases and minimizing their impact on human health.

According to the last revision of the world blackflies inventory, there are about 2415 species of blackflies, 2398 of them are living species while 17 are fossils [3].

Crosskey, 1967) documented 16 species belonging to 7 subgenus groups, distributed across five country. (Lebanon, Iran, Jordan, Egypt, and the Historic Palestine) [4]. Earlier, by Austene, 1921 one species of the blackflies recorded from the Historic Palestine [5]. , Puri 1925 recorded a larval syntype locality for *S. equinum* var. mediterraneum [6] Furthermore Bodenheimer1937 documented six species: *Simulium aureum* Fries, *S. hirtipes Fries, S*. latipes Meigen, S. *reptans* var. syriacum Roubaud, *S. varicolum Stguy*, and *S. varium* Meigen [7]. The records of the six species of blackflies from the Historic Palestine listed by Bodenheimer in 1937 could not be verified due to lack of the specimens that used for identification [7].

Based on Crosskey's (1976), it appears that there are five species of blackflies that can be found in the historic Palestine. These species are (*Simulium (Eusimulium) rufcorne Macquart,* 1838, *Simulium (Eusimulium) rubzovianum* (Serban, 1961), *Simulium (Wilhelmia) mediterraneum* Puri, 1925, *Simulium (Wilhelmia) paraequinum* Puri, 1933 and *Simulium (Ohgmia) sp*). [4].

Since Crosskey (1967) no studies related to the blackflies appears related to The Historic Palestine, and most our knowledge depend on old literature that shows generally details about this group of flies [4].

This research documentation comes to increase our knowledge to the blackflies in Palestine, including highlights the futures needs of studies related to this group of insects, to gain a better understanding of the blackfly fauna, ecology, biology, habitats, distribution and medical importance in the Palestinian territories (West Bank).

2. MATERIAL AND METHODS

2.1 Study area:

Wadi Qana, is located in the Salfit district and geographically by its coordinates 32.12582, 34.8952 (map 1). The total area of the study site is approximately 15.22 square kilometers, with a length of 20km.The region experiences a Mediterranean climate, with average temperatures 8-12 degree Celsius during winter and 22- 28 degree Celsius during summer [8].

Wadi Qana characterized by the presence of 5 natural fresh water springs that discharge in to the Wadi throughout the year. The elevation ranges from 240- 700 m above the sea level providing a diverse range of habitats for freshwater organisms [8].

2.2 Collecting Samples and identification

In January2023, a field survey was conducted in Wadi Qana protected area (32.12582, 34.8952) in Salfit district to study the fresh water fauna. All specimens collected from the ruining water that exist in the Valley with a total of 220 individual, by forceps and preserved in 70% ethanol, microscope slide were prepared for the specimens and examined under the light microscope, adults of this groups examined under the dissecting microscope.

2020 larvae were collected from January 2023 until June 2023 from fresh water habitats in tow location in the study area (70 larvae from location number one and 150 larvae from location number two). Forceps were used to pick up the larvae which were attached to rocks and water plants. All characteristics of the breeding site habitat were recorded, and the physiochemical parameters of the water (pH, temperature, electrical conductivity and dissolved oxygen) were also measure.

The collected larvae were deposited in 75% alcohol in small plastic cups (50 ml) and sent to Palestinian Institute for Biodiversity and Sustainability for identification. Adult Blakflies were also collected by hand net for species identification.

Morphological features of the larvae and adults were examined using compound and dissection microscopes. Different identification keys were used to identify the collected larvae, were identified to the subgenus. [4, 9, 10, 11, 12].adult Blckflies were collected to prove the species

3. RESULTS AND DISCUSSION

3.1 during the study period, a total 220 larvae were collected from the breeding sites in the freshwater habitats in Wadi Qana.

Blackfly larvae were found in only two breeding site locations, with 70 larvae collected from the first location and 150 larvae from the second location.

Two subgenus of Blackflies were found in the study area (*Simulium (wilhelmia)* Enderlein and and *Simulium (Odgamia)* Enderlein figures (1,2).

Simulium (wilhelmia) Enderlein,spp. larvae were collected from location number one, totaling 70 larvae."

Morphology: The widest part of the cephalic apotome is at its base; width of the postgental cleft does not exceed its depth. Cervical sclerites separated from the head capsul, hypostomium with single center tooth. Lobes of the gill spot are thick and running parallel to one another. Circle of hooks on the last abdominal segment bearing more hooks on the dorsal side than on the ventral side, ventral papillae absent. Figure (1).

3.1.1 *Simulium (wilhelmia)* Enderlein,spp

Morphology: The widest part of the cephalic apotome is at its base; width of the postgental cleft does not exceed its depth. Cervical sclerites separated from the head capsul, hypostomium with single center tooth. Lobes of the gill spot are thick and running parallel to one another. Circle of hooks on the last abdominal segment bearing more hooks on the dorsal side than on the ventral side, ventral papillae absent. Figure (1).

3.1.2 *Simulium (Odgamia) Enderlein1921,spp.*

Morphology: The widest part of the cephalic apotome is at its base; width of the postgental cleft does not exceed its depth. Cervical sclerites separated from the head capsul, hypostomium with single center tooth. Lobes of the gill spot are thin and coiled or not yet visible (earlier instar) and ventral papillae blunt rounded and inconspicuous. Figure (2).

3.1.3 Remarks: according to comprehensive revision of the taxonomic and geographical inventory 2022 the two subgenus were known a worldwide distribution (Adler 2022).

No significant health effects were recorded or documented in the study area, except for nuisance to humans and animals caused by the biting of blackflies.

3.1.4 Larval and adult habitat:

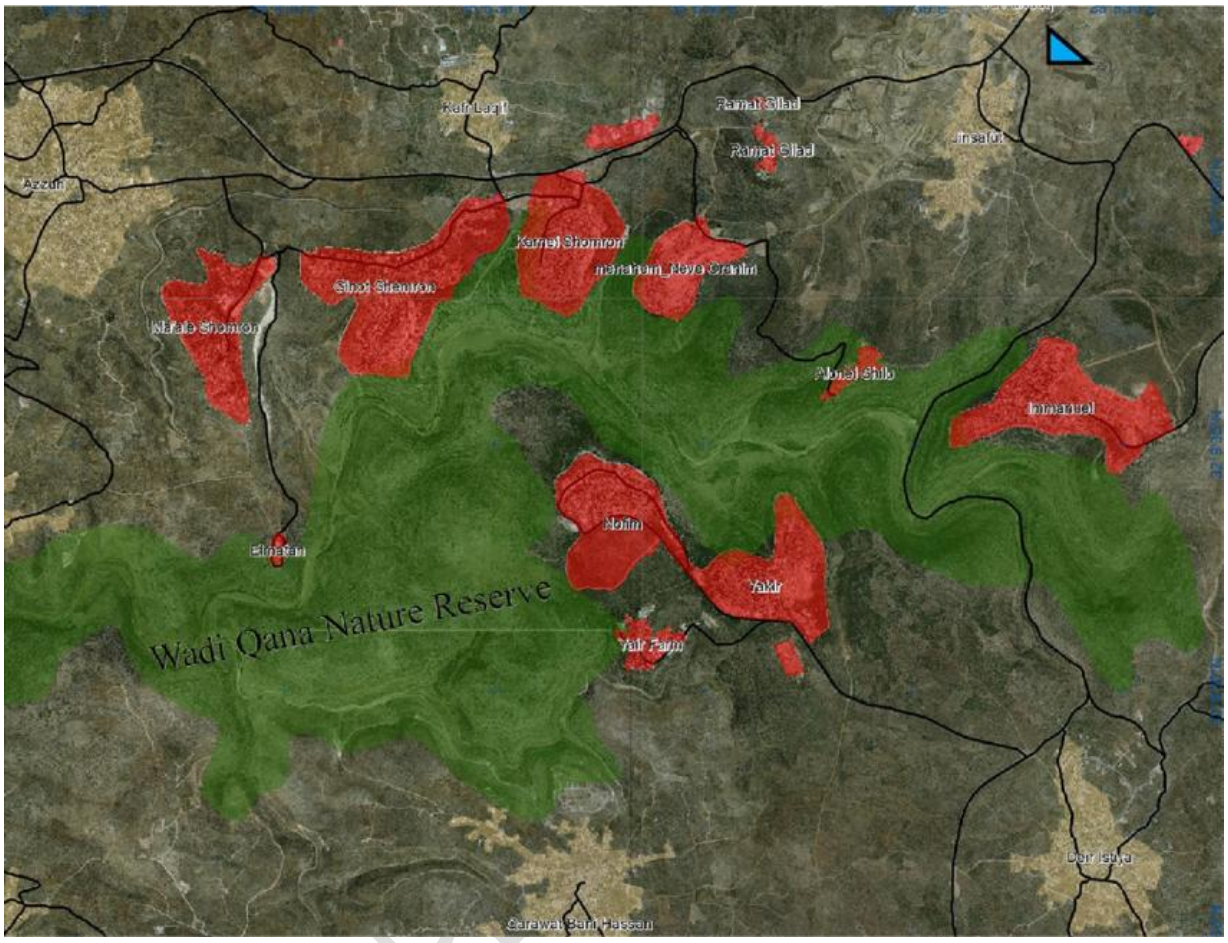
The larvae and adults were collected from the three breeding sites in the study area, characterized by fast-flowing freshwater and covered by annual water plants (figures 3, 4). The study also found that the blackflies adults bred in specific physiochemical parameter characterized by high level of dissolved oxygen and alkalinity water, table (1).

It is worth noting that there is limited information and scientific research discussing the Blackfly fauna and it is medical importance in the study area (West Bank). Therefore, our finding will contribute to helping other researcher in building a comprehensive understanding of the species fauna in the future.

Several previous studies have explored the fauna, ecology, biology, distribution, habitats, and medical importance of Blackfly. [13,14,15,16,17].

The finding of our study proved that the existence of blackfly in West Bank region. and the finding of our study align with the pervious study which indicate that these species breeding in fast-flowing freshwater habitats furthermore, the study found that the species breeding in water exhibit high oxygen level, alkaline water and elevated temperatures, consistent with pervious research.[13,14,15,16,17].

Indeed, further studies are necessary to provide a comprehensive understanding of the fauna of Blackfly and it is medical importance, while the current study contributes valuable information about the Blackfly fauna found in the study area and their breeding habitats, additional research is needed to fill in the gaps and expand our knowledge in this field.



Map1. showing the Wadi Qana location at West Bank area (Palestine Central Bureau of statistic, 2017)

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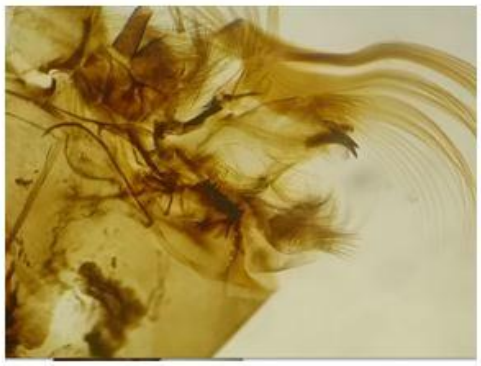
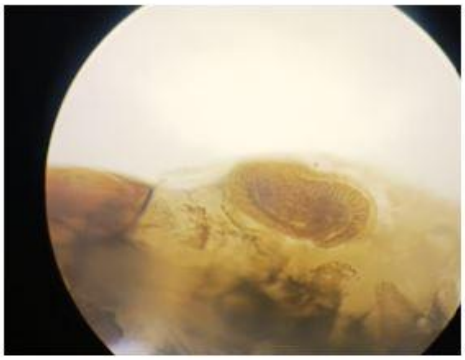


Hypostomium of *Simulium*(Wilhelmia) Enderlin



Lobs of gill spots of Simulium(Wilhelmia) Enderlin

hooks on the dorsal side on Simulium(Wilhelmia) Enderlin

Fig.1 Morphological structure of *Simulium (Wilhelmia)* Enderlin larva

Lobs of gill spots of *Simulium* (Odgamia) Enderlein.

Hypostomium of *Simulium* (Odgamia) Enderlein

Fig.2 Morphological structure of *Simulium (Odgamia) Enderlein LARVAE*

Table 1. Shows the average of physiochemical parameters for the fresh water habitats during the study period 2023

physiochemical parameters	
PH	8.2
Temp	21.6 (°C)
DO	10.1 (mg/L)
EC	810 (µS/cm),

Fig. 3 shows the breeding sites habitats for blackflies in the study area

Fig. 4 shows the breeding sites habitats for blackflies in the study area

4. CONCLUSION

blackfly was recorded for the first time in the Palestinian environment, more study research are needed to discussed the fauna and biology, ecology, habitats and the medically important.

REFERENCES

1- Adler, P. H., Cheke, R. A., & Post, R. J. (2010). Evolution, epidemiology, and population genetics of black flies (Diptera: Simuliidae). Infection, Genetics and Evolution, 10(7), 846-865.

2- Crosskey, R.W. 1990. The Natural History of Black flies. Chichester, 711 pp.

3- Adler, P.H. 2022. World blackflies (Diptera: Simuliidae): a comprehensive revision of the taxonomic and geographical inventory. http: www.clemson.edu/cafls/departments/esps/ biomia/pdfs/blackflyinventory.pdfhttps://doi.org/10.23902/trkjnat.1113991

4- Crosskey, R. W. (1967). A preliminary revision of the blackflies (Diptera: Simuliidae) of the Middle East. Transactions of the Royal Entomological Society of London, 119(1), 1-45. https://doi.org/10.1111/j.1365-2311.1967.tb00500.x

5- Austene,. E., 1921, A contribution to knowledge of the blood-sucking Diptera of Palestine, other than Tabanidae. Bull. ent. Res. 12 : 107-24.

6- Puri, I. M. (1925). On the life-history and structure of the early stages of Simuliidae (Diptera, Nematocera). Part I. Parasitology, 17(3), 295-334.

7- Bodenheimer, F.S., 1937. Prodromus faunae Palestinae: essai sur les éléments zoogéographiques et historiques du sud-ouest du sous-règne paléarctique (Vol. 33). l'Institut français d'archéologie orientale.

8- Qumsiyeh, M. B., & Al-Sheikh, B. (2023). Flora and conservation issues in two protected areas in Palestine: Wadi Al-Zarqa Al-Ulwi and Wadi Qana. Diversity, 15(2), 142. https://doi.org/10.3390/d15020142.

9- Crosskey, R. W. (1962). The identification of the larvae of African Simulium. Bulletin of the World Health Organization, 27(4-5), 483.

10- Crosskey, R. W. (2002). A taxonomic account of the blackfly fauna of Iraq and Iran, including keys for species identification (Diptera: Simuliidae). Journal of Natural History, 36(15), 1841-1886. https://doi.org/10.1080/00222930110066846

11- Eva R., Adib Z and Ekbal F. Taxonomic study of Black-flies (Diptera: Simuliidae) larvae in Al Arab River (Lattakia, Syria)., International Jornal of Scientific Research., Vol.7, Issue.2, pp.112-119, April 2022.

12- Sundermann, A., Lohse, S., Beck, L. A., &Haase, P. (2007). Key to the larval stages of aquatic true flies (Diptera), based on the operational taxa list for running waters in Germany. In Annales de Limnologie-International Journal of Limnology (Vol. 43, No. 1, pp. 61-74). EDP Sciences. https://doi.org/10.1051/limn/2007028

13- Basren, Ö., and KAZANCI, N. (2016). Water quality assessment of Fırtına Stream (Rize, Turkey) by using various macroinvertebrate based metrics and physicochemical variables. Review of Hydrobiology, 9(1): 1-16

14- Khanzadeh, F., Khaghaninia, S., Maleki-Ravasan, N., Oshaghi, M. A., & Adler, P. H. (2020). Black flies (Diptera: Simuliidae) of the Aras River Basin: species composition and floral visitation. ActaTropica, 209, 105536. https://doi.org/10.1016/j.actatropica.2020.105536

15- Bernard, D. P., Neil, W. E., and Rowe, L. (1990). Impact of mild experimental acidification on short term invertebrate drift in a sensitive British Columbia stream. Hydrobiologia, 203, 63-72.

16- Buitrago-Guacaneme, A., Sotelo-Londoño, A., Pimlla-Agudelo, G. A., García-García, A., Moneada, L. I., & Adler, P. H. (2018). Abundance and diversity of black flies (Diptera: Simuliidae) in rivers of the Andean Eastern Hills of Bogotá (Colombia), and its relationship with water stream physicochemical variables. Universitas Scientiarum, 23(2), 291-317. https://doi.org/10.11144/javeriana.sc23-2.aado

17- Rabha, B., Dhiman, S., Yadav, K., Hazarika, S., Bhola, R. K., & Veer, V. (2013). Influence of water physicochemical characteristics on Simuliidae (Diptera) prevalence in some streams of Meghalaya, India. Journal of vector borne diseases, 50(1), 18.

18- Başören, G. E., and KAZANCI, N. (2021). Ecological requirements of larval Simuliidae (Insecta, Diptera) species of some streams in Camili Valley (Artvin, Turkey). ActaAquaticaTurcica, 17(1), 97-107. https://doi.org/10.22392/actaquatr.757088