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Research Article

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A preliminary recording of insects on the island of Farwa Northwest of Libya

Hoda M. Elmareme[1], Abdulhamed M. Etriieki[2*], Asmaa D. Mkhebesh[3], Ali A. Bataw[4], Munay A. Albarbar[5], Nahad S. Ben Omar[6]

Corresponding author: abdulhamed.etriieki@gu.edu.ly, Department of Zoology, Faculty of Science, University of Gharyan, Gharyan, Libya

[1] Department of Zoology, Faculty of Science, University of Tripoli, Tripoli, Libya.

[3] Department of Ecology, Faculty of Science, Sabratha University, Sabratha, Libya

[4] Department of Zoology, Faculty of Science, University of Omar Al Mukhtar, Al-Bayda, Libya

[5] Department of Zoology, Faculty of Science, University of Tripoli, Tripoli, Libya.

[6] Department of Zoology, Faculty of Science, University of Tripoli, Tripoli, Libya.

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Abstract

The study aimed to present the first record of insect families in Farwa Island. Farwa Island is the largest and most important island in Libya; located in Northern west part of Libya in the Mediterranean, its insect fauna is poorly studied. Short time intensive collection of insect samples was conducted in four areas (mouth of the valley, bay of containers, center of the Island, and Ras-Attalgha) in February, March and April 2021. Different methods were used for insect collection, sorting, preservation and later identification to the lowest taxonomic level and verification. 9 orders, 31 families, 40 genera and 58 insect species were collected in the study; the center of the Island had the highest numerical density and diversity of insect fauna due to its diverse vegetation compared to other areas. Diverse suitable habitats and absent insect control measures provided suitable environmental conditions for insects breeding, feeding and hiding from enemies. This study constitutes the first comprehensive survey of insect fauna on Farwa Island and adds significant value to the ongoing assessment of insect diversity in Libya. A long-term study has to be conducted to investigate detailed information about the abundance and diversity of insects and other arthropods on Farwa Island.

Keywords: Collection, Biodiversity, Farwa Island, Insect fauna, Libya

INTRODUCTION

Insects are invertebrate animals (Phylum: arthropods) that comprise the largest known and most widely distributed group (Class: Insecta) of multicellular organisms worldwide. Although the estimates of their numbers may vary, most entomologists agree that there are approximately 1.1 million described insect species. However, estimates of their actual number vary from 1.5 to 5 million species, and a consensus is converging on about 3.5 million species (roughly three times the number of described species) (Grimaldi, 2023). Insects are found in almost all environments, on plants, around

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buildings and under objects such as rocks and tree trunks; aquatic insects can be found in lakes, ponds, streams, rivers and swamps. Many insects have direct or indirect impacts on humans (pests as those considered parasitic, disease-transmitting vectors or homes/agricultural products destroying organisms). Moreover, insects are considered the most ecologically significant land organisms based on their large biomass. Some insect species are very destructive to forests and crops, but they constitute only a small percentage, and their numbers are biologically controlled by parasitoids and predatory insects. About 80-85% of the world's flowering plants are pollinated by insects; some insect products (honey, silk, dyes, wax and sustainable protein) are indispensable materials for humans. The fruit fly *Drosophila melanogaster* (as an experimental organism) has inspired the scientific society with many significant discoveries and breakthroughs in biology and other related fields (Grimaldi and Engel, 2005; Mohamed and Shaurub, 2010; Grimaldi, 2023).

Farwa Island is the biggest and most significant Island in Libya. It is situated 150 km west of Tripoli in the Northwest part of Libya on the Mediterranean Sea at the border region between Libya and Tunisia. The Island is roughly 12 km long with a maximum width of approximately 3 km, and the total surface area is about 31 km^2. Coordinates: 33°06'20.3"N 11°44'39.2"E. With its location in the Mediterranean climate zone, Farwa Island has a temperate climatic condition with sunny days and northern winds dominating most of the year. The mean annual temperature is 20ºC and the mean annual rainfall reaches 190 mm. The Island is characterized by a diverse collection of habitats (beaches, drying salt lakes, trees, sand dunes, marshes, mudflats and widespread tidal areas). These diverse environments provide a suitable habitat for many floral and faunal species (Etayeb, 2002; Etayeb and Essghaier, 2007; EGA-RAC/SPA, 2012; Isemmann *et al*., 2016).

Studies in Farwa Island on invertebrates groups generally and insect fauna particularly are poor. To the best of our knowledge, one previous study was conducted on invertebrates on this Island; the study by Jdeidi *et al.* (2015) revealed insects as the most abundant organisms (most of which were Coleoptera followed by Lepidoptera, Diptera, Hymenoptera and Orthoptera); it also included spiders and scorpions. This research introduces the first thorough study of recorded insect families in Farwa Island.

MATERIALS AND METHODS

The study was conducted during the months of February, March and April 2021. The Island was divided into four areas: mouth of the valley, bay of containers, center of the Island, and Ras-Attalgha. (Figure 1).

The following tools and equipment were used: tweezers, manual collection net, white cloths (2 x 3 meters), umbrella with a diameter of 1 meter, jars of different sizes, plastic/glass tubes and containers for collecting ground insects, magnifying glass, notebook for recording sample data (sample number, date of collection and place of sampling). Each area was visited where samples were collected using different collection methods from using forceps to methods of hitting and shaking branches of the bushes.

The samples were collected over two periods from 10 am to 1pm and from 2 pm to 5 pm, kept alive in jars or plastic/glass tubes, sorted and labeled in the field based on areas and deposited in the laboratory of the biology department, faculty of science, University of Tripoli. They were then killed using pieces of cotton filled with 75% ethanol in sealed jars/tubes, and then pinned in tightly sealed insect boxes for later identification and verification. Classification to the lowest possible taxonomic level was conducted at the University of Tripoli and laboratory of biology department, faculty of science, Omar Al-Mukhtar University (Al Bayda) using binocular microscope and special references (Zavattari, 1934; Borror *et al.,* 1981; Beccaloni *et al.,* 2005; Lamas, 2008; Massa, 2009;

Kirk-Spriggs and Sinclair, 2017). The data of each sample and the level of its classification were placed on special sample cards for the purpose of permanent preservation and reference when needed.

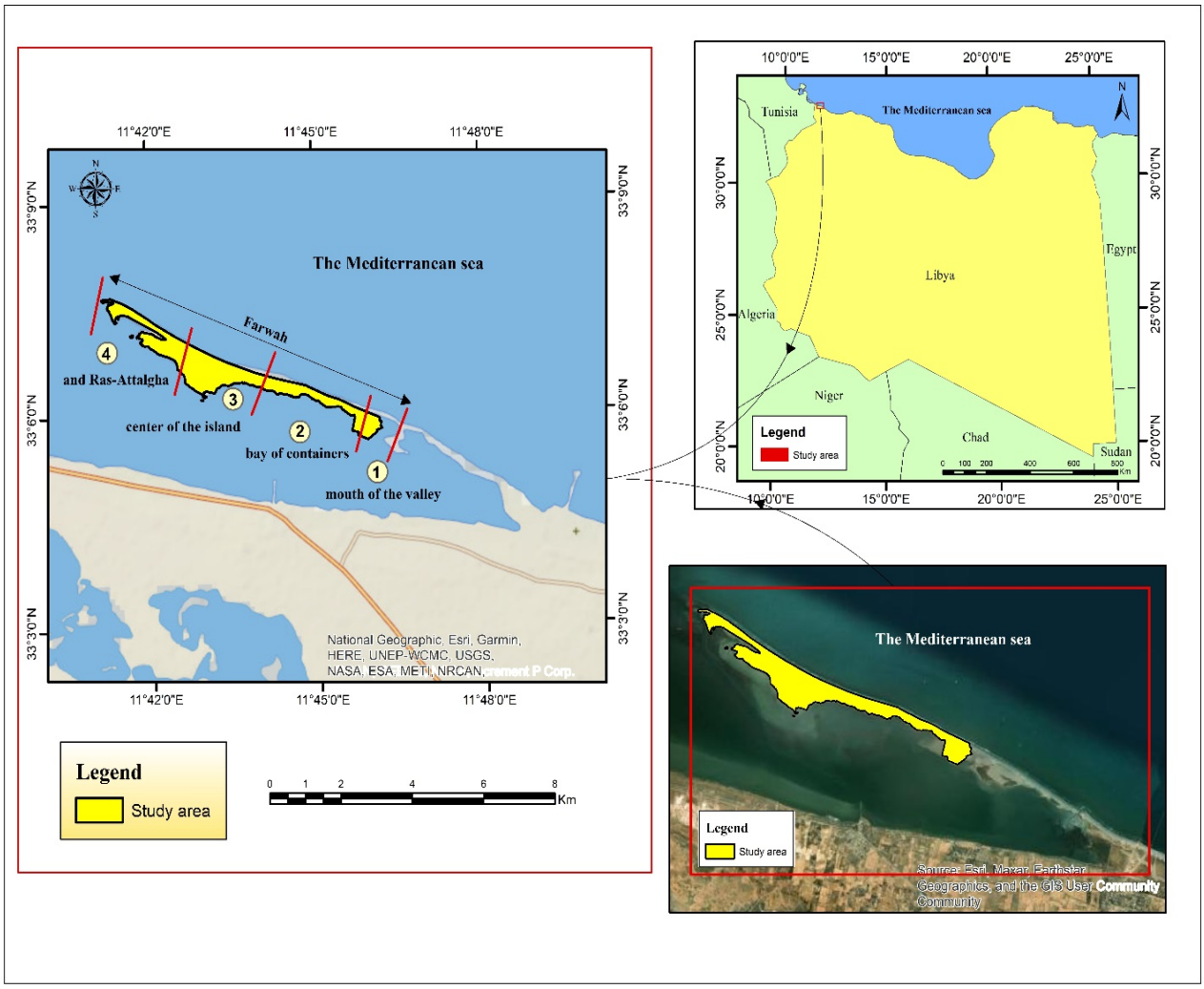

Figure: (1). Study area (Farwà Island) in the Northwest of Libya, divided into four regions: 1. mouth of the valley, 2. bay of containers, 3. center of the Island, and 4. Ras-Attalgha

RESULTS

The study collected 58 insect species belonging to 40 genera, 31 families and 9 orders, and they were arranged in (Table 1), followed by the scientific names for each insect. Four samples could be identified only to the family level (Asilidae, Reduvidae, Silphidae and Tetrigidae).

Table:(1). Orders, families and the scientific names of the collected specimens.

Order	Family	Scientific name
Coleoptera Linnaeus 1758	Carabidae Latreille 1802	*Scarites terricola* Bonelli 1913
	Cetoniidae Leach 1815	*Lophyra flexuosa* Fabricius 1787
		Oxythyrea funesta Poda 1761
		Oxythyrea pantherina Gory and Percheron 1883
	Coccinellidae Latreille 1807	*Coccinella septempunctata* Linnaeus 1758
		Coccinella undecimpunctata Linnaeus 1758
	Scarabaeidae Latreille 1807	*Oxythyrea tripolitana* Reitter 1891
	Silphidae Latreille 1806	
	Tenebrionidae Latreille 1807	*Blapistinus histricus* Casey 1890
		Erodius zophosoides Allard 1865
		Erodius bicostatus Solier 1934
		Gonocephalum perplexum Lucas 1846
		Himatismus villosus Haag-Rutenberg 1870
		Phaleria acuminata Küster 1852
		Pimelia granulata Solier 1836
		Pimelia obsoleta Solier 1836
		Pimelia urticata Klug 1830
		Tentyria latreillei Solier 1835
		Tentyrina duplicata Reitter 1900
Dermaptera De Geer 1773	Forficulidae Stephens 1829	*Forficula auricularia* Linnaeus 1758
	Labiduridae De Geer 1773	*Euborellia annulipes* Lucas 1847
Diptera Linnaeus 1758	Asilidae Loew 1848	
	Bombyliidae Latreille 1802	*Systoechus vulgaris* Loew 1863
	Calliphoridae Robineau-Desvoidy 1830	*Calliphora vicina* Robineau-Desvoidy 1830
		Lucilia caesar Linnaeus 1758
		Lucilia sericata Meigen 1826
	Muscidae Latreille 1802	*Musca domestica* Linnaeus 1758
	Sarcophagidae Linnaeus 1758	*Sarcophaga carnaria* Linnaeus 1758
	Syrphidae Latreille 1802	*Eristalis tenax* Linnaeus, 1758
Hemiptera Linnaeus 1758	Coreidae Leach 1815	*Anasa tristis* De Geer 1773
	Lygaeidae Schilling 1829	*Spilostethus pandurus* Scopoli 1763
	Pentatomidae Leach 1815	*Eurygaster hottentotta* Fabricius 1775
	Reduvidae Linnaeus 1758	
Hymenoptera Linnaeus 1758	Apidae Linnaeus 1758	*Xylocopa ruficeps* Friese 1910
	Formicidae Latreille 1809	*Cataglyphis bicolor* Fabricius 1793
		Cataglyphis nigra André 1881
		Cataglyphis nodus Brullé 1833
		Cataglyphis oasium Menozzi 1932
		Cataglyphis viatica Fabricius 1787
		Messor aegyptiacus Emery 1878
		Messor arenarius Fabricius 1787
		Messor barbarus Linnaeus 1767
		Messor minor André 1883
	Scoliidae Latreille 1802	*Scolia erythrocephala* Fabricius 1798

Order	Family	Scientific name
Lepidoptera Linnaeus 1758	Lycaenidae Leach 1815	*Aricia agestis* Denis and Schiffermüller 1775
	Noctuidae Latreille 1809	*Agrotis infusa* Boisduval 1832
	Pieridae Swainson, 1820	*Pieris brassicae* Linnaeus 1758
		Pieris rapae Linnaeus 1758
		Pontia daplidice Linnaeus 1758
	Pterophoridae Zeller 1841	*Gillmeria pallidactyla* Haworth 1811
	Zygaenidae Latreille 1809	*Zygaena felix* Oberthür 1876
Odonata Fabricius 1793	Libellulidae Rambur 1842	*Sympetrum decoloratum Selys 1884*
		Sympetrum fonscolombii Selys 1840
Orthoptera Latreille 1793	Acrididae MacLeay 1819	*Acrotylus insubricus* Scopoli 1786
		Oedipoda caerculescens Linnaeus 1758
		Oedipoda fuscocincta Lucas 1849
		Oedipoda miniata Pallas 1771
		Omocestus rufipes Zetterstedt 1821
		Truxalis nasuta Linnaeus 1758
	Gryllotalpidae Saussure 1870	*Neocurtilla hexadactyla* Perty 1832
	Tetrigidae Rambur 1838	
Thysanura Linnaeus 1758	Lepismatidae Linnaeus 1758	*Lepisma saccharina* Linnaeus 1758

DISCUSSION

Insects are indispensable organisms for life on earth and for the functioning and sustainability of all ecosystems (Saxena and Omkar, 2023). Based on a short-term intensive survey, this paper constitutes the first comprehensive collection of insects on Farwa Island. Moreover, in view of the importance of the study of insects in Libya in general and Farwa Island in particular, this study (represented by 9 orders, 31 families, 40 genera and 58 insect species) was compared to other similar studies; a study conducted by Yahiya (2014) included similar families (Coreidae, Lycaenidae, Lygaeidae, Pentatomidae, Pieridae). Similarly, a study by Mifsud (2000) had Carabidae, Coccinellidae, Formicidae, Sarcophagida and Tenebrionidae, and another study by EL-Meghrabi (2009) included Lygaeidae, Pentatomidae and Reduvidae, all of which were recorded in this survey. This study recorded the presence of families Zygaenidae, Noctuidae, Silphidae, Scoliidae, which were not present in the aforementioned studies (Yahiya, 2014), (Mifsud, 2000), (El-Meghrabi, 2009). 77 families obtained in the aforementioned studies were not recorded in this survey. This study was the first of its kind in the sampling and classification of insects on the Island, specifically among the areas and environments in which insects were collected and classified.

This insect biodiversity was due to the presence of many suitable habitats that may provide appropriate environments for both insects breeding and hiding from enemies. Moreover, the absence of control measures also helped to increase the abundance and distribution of insects in the study area

The results were obtained from samples collected only from Farwa Island and a multiplicity of insect habitats was observed, especially in the central region of the Island because of the diversity of vegetation compared to the number of visits to the study areas. On the other hand, the rest of the study areas, such as the mouth of the valley, and Ras-Attalgha, had the least numeri-

cal density and diversity of insect families due to the large number of waves and sea currents that result in strong winds for the two areas and thus the inappropriateness of climatic conditions, in addition to the scarcity of vegetation. The presence of insect families near plants was more abundant, followed by sand, and the least was near dung and carrion.

CONCLUSION

The results of this short time intensive survey of insects on Farwa Island showed that the Island has relatively abundant and diverse insect fauna. This is due to the fact that the Island provides suitable environments for insects breading, feeding and escaping enemies; the absence of insect control measures adds to this rich biodiversity. Based on this comprehensive collection of insects from Farwa Island, this research adds important value to the continuously growing evaluation of the insect fauna in Libya.

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ETHICS

This article is original. The authors declare no ethical issues that may arise after the publication of this manuscript.

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