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## The study of insects diversity and composition within El Musawwarat area from (2008- 2012), Shendi, Sudan

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**Abstract**

Within the semi desert region, the spatial variation in vegetation types is expected to affect both the density and diversity of insects. This study looked at the comparative analysis of insects in El Musawwarat area in semi desert area near Shendi, Naher Elneel state, Sudan. Also the distributions of the insects, according to vegetation types have been assessed.

Insects collected from the study area in the period (2008-2012), using dishes, 30 cm × 10 cm. Which has been put in transect (50 m), and also Butterfly nets have been used for flying insects. A total number of 1142 individuals representing 17 Insects Orders, Collembola, Thysanura, Odonata, Ephemeroptera, Embioptera, Dictyoptera, Isoptera, Dermaptera, Phasmida, Orthoptera, Neuroptera, Thysanoptera, Diptera, Coleoptera, Hemiptera, lepidoptera and Hymenoptera. Diptera showed higher abundance and diversity in the families compared to other insects' orders which had 248 individuals represented by 14 families. Order Thysanoptera showed minimum abundance in the overall collection. Results revealed no difference in diversity of insects between different study periods. Furthermore the averages of insects were caught from inside more than outside. In addition, insects showed activity during the day more than night. In general, these results indicate that the community of insects at El Musawwarat area is characterized by considerable stability against spatial and temporal environmental fluctuations. This study aimed to be a pilot for future studies for El Musawwarat insects.

**Keywords:** Insects diversity, composition, Sudan

**1. Introduction**

The popular conception of a desert as a region of drifting sand, devoid of vegetation except for an occasional oasis, may apply to certain area but is not means characteristic of all deserts or arid regions. Indeed, arid region are as diverse as the climatic and geological factors that produce them. Buxton (1923) used the word desert is used to include those places in which the climate is hostile to animals and plants, in which normal agriculture is impossible. Semi desert is applied to a region where the climate is less hostile, the fauna and flora are less specialized, cultivation supported at certain seasons and grazing. The country around Khartoum in the Sudan is a good example of this, which is a semi-desert region often referred to as Acacia desert scrub. Insects are extraordinarily adaptable creatures, having evolved to live successfully in most environments on earth, including desert, and ataractic Hoffmann and Frodsham (1993) [5]. Publications on survey of the insect fauna of Khartoum are meager. This kind of research has been initiated also by Cloudsly-Thomoson (1964) [3] who recorded the seasonal fluctuation and effect of grazing on desert insects fauna near Khartoum. Desert insects in Sudan have received little or no attention. The richness of fauna beside the Nile, compared to surrounding desert is well document and reported by several authors Rzaska, J. (1961) [9].

El Musawwarat announced as a Nature protected area in 1994, protected from human activity like animal grazing. Six wells were digging in different parts in El Musawwarat area, in addition to that different types of trees (*Acacia* sp, Fruits trees Palm trees..... etc) have been introduced in El Musawwarat area, all this changes support the biodiversity in this area.

**1.2. Objective of Study**

- To assess the community's composition and diversity of insects in El Musawwarat in the different study periods.
- To study the distribution of the insects, according to vegetation types and check the

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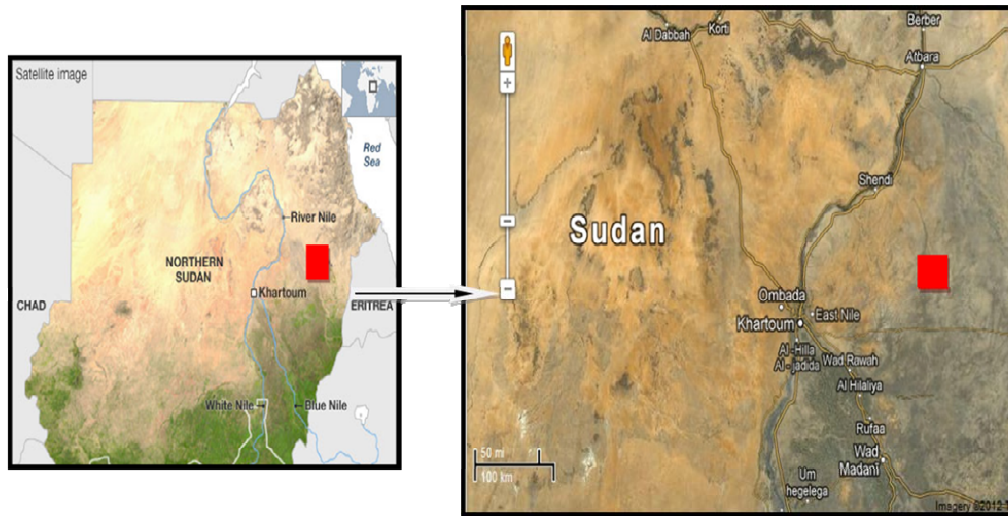
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introduced species to the area

- To compare the abundance of insects inside the protecting area and outside to use this data as data base to El Musawwarat area also to know later the effects of the changes in the study area.

## 2. Materials and Methods

### The study area



 Show the location of El-Musawwarat

**Plate 1:** The view of El Musawwarat protecting area.

### 2.1 The study are

The study was carried out in El Musawwarat east to the supra wadi (16° 22' N, 33° 22' E), 30 Km away from the Nile and about 170 Km from Khartoum. The study area is located in front of the slope of the mountains or (valley).

El Musawwarat contains protecting the area and it has more plants compare with the environment outside.

### 2.2 Climate

Musawwarat Elsufra belongs to Shendi region, referring to Sudan Metrological Authority. Which is considered dry tropics and distinguished with its high mean temperature throughout the year, the yearly average is (35 - 48) °C.

The daily maximum temperature is highest in June while the lowest temperatures were recorded in January.

Rainfall of the Shendi region covers the period from July to September is about 13 mm during the last five years, except September and October 2006, which registered 64.5 mm and 51.8 mm respectively (Sudan Metrological Authority).

### 2.3 Vegetation

The area studied belongs to the *Acacia* desert scrub Andrews, F.W. (1948) [1]. Andrews identified the *Acacia* desert scrub with the rainfall belt laying between the 50 mm and 300 mm. There were some kind of new species which had been introduced and they are not desert plant.

**Table 1:** List of identified plants in El Musawwarat.

Scientific Name
<i>Calotropis procera</i> (Aiton) W.T.Aiton
<i>Leptadenia pyrotechnica</i> (Forssk.) Decne
<i>Heliotropium aegyptiacum</i> . Lehm
<i>Maerua crassifolia</i> . Forssk
<i>Citrullus colocynthis</i> . (L.) Schrad
<i>Acacia seyal</i> . Hayne
<i>Acacia mellifera</i> . Hayne
<i>Acacia tortilis</i> . (Forssk.) Hayne
<i>Acacia ehrenbergiana</i> . Hayne
<i>Senna alexandrina</i> . Mill
<i>Stipagrostis uniplumis</i> . (Licht. ex Roem. & Schult.) De Winter
<i>Fagonia</i> sp. L.
<i>Tribulus terrestris</i> L.
<i>Convolvulus auricomus</i> . (A.Rich.)
<i>Balanites aegyptiaca</i> (L.)
<i>Ziziphus spina-christi</i> (L.).
Introduced plants
<i>Phoenix dactylifera</i> (Date Palm)
<i>Citrus limonum</i> (limon)
<i>Psidium guajava</i> (Guava)

## 2.4 Specimens Collection

Insects' samples collected annually from 2008 to 2012, 10 days spend in the field work to cover all sits. Insect habitats have been observed as well as activity time. The specimens were collected on dishes, 30 cm×10 cm has been put in transect (50 m) crossing the area from west to the east. Butterfly nets were used for flying insects and others were collected with the help of forceps. Insect's attraction toward light has been exploited during insect's collection at night. Specimens were killed by chloroform and preserved in 70% ethanol. Classification of specimens was based on Picker *et al.* (2004) [8].

## 2.5 Statistic analyses

Microsoft® Excel 2007 was used to construct graphs and bi chart. The At analysis of variance test (one-way ANOVA) was used when comparing the number of individuals captured in all study period, also T test was used to compare the number of insects outside the protecting area and inside.

## 3. Results

### 3.1 General overview of insects found

A total of 1142 individuals representing 17 orders and 54 families were recorded in this study. The dominant order was Diptera, which had 248 individuals (Table 1) and 12 families (Table 2). On other hands order Thysanoptera show less diversity in the number of individuals were collected in all study period.

**Table 2:** Total number of insects belonging to different orders were collected in study period from (2008-2012)

Insects Orders	2008	2009	2010	2011	2012	Total
Collembola	0	12	17	62	104	195
Thysanura	0	0	1	2	2	5
Ephemeroptera	0	0	8	1	1	10
Odonata	2	0	4	3	40	49
Orthoptera	15	6	7	64	75	167
Phasmida	2	1	7	3	4	17
Dermaptera	0	0	0	1	2	3
Embioptera	0	0	2	1	0	3
Dictyoptera	4	2	13	32	30	81
Isoptera	0	2	0	0	10	12
Hemiptera	2	4	22	173	22	223
Neuroptera	10	8	13	17	17	65
Thysanoptera	0	0	0	2	0	2
Coleoptera	12	8	22	18	34	94
Diptera	42	23	60	94	29	248
Lepidoptera	50	40	20	21	53	184
Hymenoptera	10	15	22	76	87	210
<b>Total</b>	<b>132</b>	<b>103</b>	<b>181</b>	<b>435</b>	<b>286</b>	<b>1142</b>

**Table 3:** The Insects families and insects activity during the study period, also the insects' habitats which had been observed during insects collection.

Order	Family	Activity	Habitats
Thysanura	Lepismatidae	Diurnal	Under stone
Collembola	Entomobryoidae	Diurnal	Leaf litter
Coleoptera	Tenebrionidae	Diurnal	Sandy area
	Scarabaeidae	Diurnal	Arid region
	Carabaeidae	Nocturnal	Sandy area
	Buprestidae	Diurnal	Vegetated area
	Cerambycidae	Diurnal	Diverse
	Ctenoidea	Diurnal	With flowering plants
	Coccinellidae	Diurnal	Low vegetations
	Meloidae	Nocturnal	Vegetated area
Hemiptera	Elateridae	Diurnal	Diverse
	Pentatomidae	Diurnal	Gardens
	Lygaeidae	Diurnal	Vegetated area
	Coceidae	Diurnal	Gardens
	Aphididae	Diurnal	Vegetated area
Diptera	Cicadidae	Diurnal	Grass land
	Calliphoridae	Diurnal	Open ground
	Nemenistridae	Nocturnal	Vegetated area, Indoors
	Tapanidae	Diurnal	Dry sand
	Asilidae	Diurnal	Around ants nests
	Culicidae	Nocturnal	Indoors

	Muscidae	Diurnal	Indoors and arid ground
	Sarcophagidae	Diurnal	Open ground
	Chironomidae	Diurnal	Around trees
	Hippoboscidae	Diurnal	Around trees
	Syrphidae	Diurnal	Vegetated area
	Tephritidae	Diurnal	Vegetated area
	Psychodidae	Crepuscular	Grass land
	Drosophilidae	Diurnal	Around trees
	Sciaridae	Diurnal	Moist habitats
Orthoptera	Acrididae	Diurnal	Trees, short grass
	Gryllidae	Diurnal	Short grass
	Stenobelmatidae	Nocturnal	Sandy habitats
	Tettigoniidae	Diurnal	Scrub
Lepidoptera	Arctiidae	Nocturnal	Attracted to lights
	Papilionidae	Diurnal	Vegetated area
	Sphingidae	Nocturnal	Attracted to lights
	Pieridae	Diurnal	Grass
	Geometridae	Nocturnal	Attracted to lights
Dictyoptera	Mantidae	Day and night	Trees , Attracted to lights
Hymenoptera Wasps	Vespidae	Diurnal	Divers
	Chrysididae	Diurnal	Terrestrial habitats
	Sphecidae	Diurnal	Widespread
	Braconidae	Diurnal	Trees ,short grass
	Eumenidae	Diurnal	Indoor ,diverse
Ants	Formicidae	Diurnal	Arid region ,Acacia scrub
Bees	Apidae	Diurnal	Diverse
	Anthophoridae	Diurnal	Trees
Phasmidae		Diurnal	Tree branches , grass
Thysanoptera		Diurnal	Vegetated area, gardens
Neuroptera	Myrmeleonidae	Day and night	Trees , Attracted to lights
	Chrysobidae	Day and night	Trees , Attracted to lights
Ephemeroptera		Diurnal	Attracted to lights
Isoptera		Diurnal	Tree, rooting wood
Odonata	Libellulidae	Diurnal	Above water bodies
	Coenagrionidae	Diurnal	Rest at dry grass
	Lestidae	Diurnal	Grassy area
Dermaptera		Nocturnal	Vegetated area, around the light
Embioptera	Oligotomidae	Diurnal	Fragile, trees

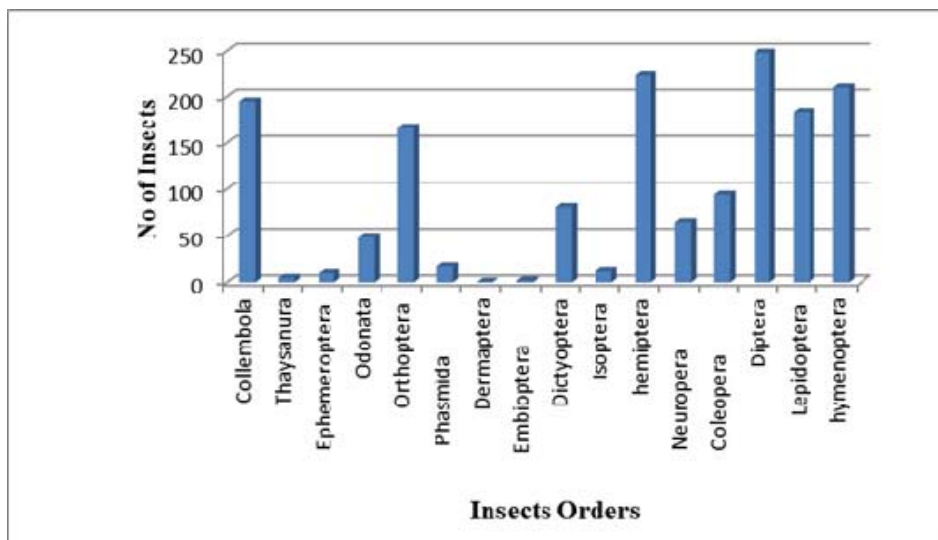
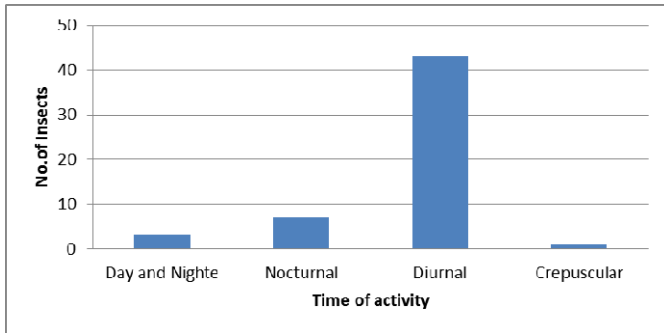


Fig 1: No of insects Order were collected from study area in all study periods from (2008-2010).

The analyses between study periods suggest that there is no significant difference in the diversity of insects in different study periods (DF=4, F= 2.59, P> 0.04).

### 3.2 Diversity of Insects according to the activity time

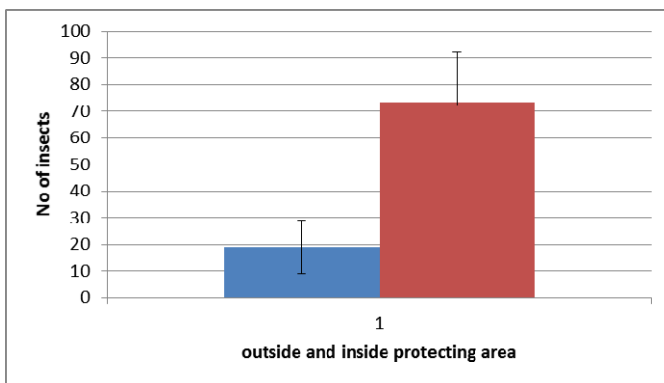
The study showed that insects are active during day more than night especially in the morning.



**Fig 2:** Insects in El Musawwarat area active during the day more than night and crepuscular insects have less number.

**Table 4:** The No of insects collected from outside and inside the protecting area in all study period.

Insects order	outside insects	inside insects	Total
Collembola	0	195	195
Thysanura	1	4	5
Ephemeroptera	8	2	10
Odonata	10	39	49
Orthoptera	84	83	167
Phasmida	4	13	17
Dermaptera	0	3	3
Embioptera	0	3	3
Dictyoptera	56	25	81
Isoptera	12	0	12
hemiptera	20	203	223
Thysanoptera	2	0	2
Neuroptera	12	53	65
Coleoptera	12	82	94
Diptera	21	227	248
Lepidoptera	46	138	184
hymenoptera	35	175	210
<b>Total</b>	<b>323</b>	<b>1245</b>	<b>1568</b>



**Fig 3:** Variation of insects outside and inside the protecting area.

The analyses of insects outside and inside the protecting area show that there is different between insects abundance inside and outside the protecting area ( $F= 4.91826$ ,  $T= 1.729133$ ,  $P> 0.008491$ ).

#### 4. Discussion

Results from this study suggested that the insects abundance was same and there is no significant difference between the study periods, number of collected insect's orders was same in all collection periods. According to Nadkarn M. (2000) [7], ecosystem might be very complex. For example, the relation between insects and vegetation diversity had not been looked at in great detail, nor has the possible difference between insect communities at ground canopy level. Therefore, there is

a need to consider the complexity of vegetation beyond types for instance to consider the associated insects and vegetation types present.

17 insects orders were collected from El Musawwarat area from 2008 to 2012 represented by 54 insects family. Order Diptera showed highest number and that may be due to the fact that most adult Dipterans prefer damp vegetating in shaded area. Furthermore, larvae depend mainly on litters of trees for feeding [4], which is provided in El Musawwarat. Also, some parasites Diptera belonging to family Hippoboscidae were found that attribute to animals found around the study area. Some orders present one time in all study periods like order Thysanoptera (Table 2), on other hand Order Coleopteran present in all study periods, especially members of family Tenebrionidae which is mainly adapted to arid and desert area. In general, Insects were found inside the protecting area more than outside. This might have been influenced by high abundance of Diptera and Collembola which are found around trees. Insects in El Musawwarat area active during the day more than night and crepuscular insects have less number which is presented by sand flies which belong to Psychodidae family. Some insects have been observed at night and during the day such as order Neuroptera. Predaceous insects like mantids predator on insects that attracted to the light at night. Some studies suggest that huge diversity of insects today is can be attributed to the diversity of plants. In El Musawwarat there is a vast diversity of insects families and this might be due to the diversity of plants species like *Leptadenia pyrotechnica sp*, *Calotropis procera* and fruit trees like *Psidium guajava* (Guava) especially inside the protecting area. Overall, the results suggest that the increase in plant cover inside the protected area might affect on the weather and there is no doubt that weather plays a major role in determining the survival and growth rates of insect populations because of its direct impact on them and on their food supply John C. P (2011) [6] also the vegetation can provide a food source for insects this affecting in the number and diversity of insects, the increase in insects number indicates the adaptation of insects of desert life

#### 5. Conclusion

It is important to know the Insects composition and diversity in each area. Insects can be used as a bio indicator of environmental health. This study can considered as references for future insect faunistic studies of El Musawwarat insects.

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