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DENSITY AND DIVERSITY OF THE DESERT ARTHROPODA OF QATAR

By

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كثافة وتنوع المفصليات الصحراوية في دولة قطر

فيصل تاج الدين أبو شامة

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أهتم البحث بدراسة كثافة وتنوع المفصليات في بيئات صحراوية مختلفة في دولة قطر ، واعتمدت الدراسة على المسوحات النهارية خلال بداية فصل الخريف (أكتوبر ١٩٩٥م ، ١٩٩٦م) والربيع (أبريل ١٩٩٦م ، ١٩٩٧م) وتركزت في مناطق صحراوية متباينة شملت الروضات والتلال الرملية والسبخات.

بينت التسجيلات الميدانية الفورية الإختلافات في العوامل المناخية المتمثلة في حرارة الهواء والرطوبة النسبية وحرارة سطح التربة وسرعة الرياح بين مناطق الدراسة المختلفة في فصلي الخريف والربيع.

ثبت بأن خصائص التربة المتعلقة بقوامها ونسبة تشبعها بالماء والمواد العضوية والأملاح تؤثر تأثيراً مباشراً على الغطاء النباتي وبالتالي وجود المفصليات وانتشارها.

تمثل شعبة المفصليات أكثر مجموعة من الحيوانات في جميع مناطق الدراسة حيث تم جمع وتصنيف حوالي ٧٩ نوع من المفصليات تتبع لطوائف العنكبيات والقشريات والحشرات وقد شكلت الحشرات الطائفة السائدة في الكثافة والتنوع، وسجل أعلى تنوع للحشرات في التلال الرملية بينما تفوقت الروضات بكثافة أعلى وافتقرت السبخات لكلا التنوع والكثافة.

تواجدت مفصليات التربة بكثافة وتنوع أكثر في تربة الروضات خاصة في فصل الربيع كما تم جمع بعض أنواع المفصليات المائية من البرك المتجمعة بعد هطول الأمطار في أبريل عام ١٩٩٦م في روضة الكرعانة.

تدل نتائج هذه الدراسة على أن الصحراء القطرية ورغم صغر مساحتها بالمقارنة مع الصحارى الأخرى تتميز ببيئات مختلفة تحتضن مجموعات متنوعة من المفصليات تمثل القدر الأكبر من الكتلة الحية الحيوانية، مما يشير لأهمية دورها في الداينميكية الحيوية والتوازن البيئي الصحراوي الأمر الذي يتطلب إجراء دراسات أشمل في المستقبل.

Keywords: Arthropoda, Desert, Qatar.

ABSTRACT

Density and diversity of arthropods were studied at different habitats of the Qatari desert. Diurnal sampling was conducted at two seasons of the year, the end of the dry season, at the beginning of autumn (October) in 1995-1996, and in spring (April) in 1996-1997. The habitats selected included land-depressions *(roda)*, sand dunes *(nijyan)* and salt mud flats *(sabkha)*. Variations in macroclimate were apparent in the records of air temperature, relative humidity, soil surface temperature and wind speed. Soil characteristics (texture, moisture content, organic content and salt content) were found to affect plant biomass and consequently the occurrence and distribution of the arhropods. Arthropods represented the major animal taxon in all the localities studied, and members of the class Insecta were dominant both in density and in diversity. Insect diversity was highest in the sand-dune locality while a higher density was recorded in land depressions. Salt-mud flats sustained the lowest density and diversity. Soil arthropod fauna was richer in land depression samples collected from Rodat Um Alamad in April 1996. Temporary rain pools in Rodat Alkaraana investigated in April 1996, supported a variety of aquatic arthropod species.

This indicates that the Qatari desert, though comparatively small, embodies distinct localised habitats. These support diverse assemblages of arhropods which constitute the bulk of the animal biomass. The role played by arthropods in the structure and functions of the desert is most probably considerable in the overall balance of this delicate ecosystem.

INTRODUCTION

Publications describing the entire faunas of desert arthropods are few. Some of them (1, 2, 3) consider faunal sub-units that occupy a series of adjacent habitats and provide a basis for understanding community structure in a biogeographical context. Arthropods have been reported to comprise the bulk of animal biomass in deserts compared with the biomass of vertebrates (4, 5). Nevertheless, their local abundance was found to be limited in space and time and affected greatly by the presence of shelter and food resources (6). Local movements make it difficult to assess their absolute density and diversity.

Information on the occurrence and distribution of desert arthropods in Qatar is limited. Few groups have been identified but several species of butterflies have been identified (7), and a list of 170 insect species collected from desert localities, farms and house-gardens has been published (8). Two species of woodlice, *Porcellio evansi* Omer-Cooper and *Purcellionides pruinosus* (Brandt) have been recorded (9) and partially engorged female ticks *Hayalomma impeltatum* (Schultze and Schlottke) collected while feeding on camels (10).

The Qatari desert lying between longitude 50° 45'-51° 40' E and latitude 24° 27'-24° 10' N, is an extension of the Arabian Desert. It is a hot desert with very hot summer and mild winter (the mean annual temperature is 42°C while the mean minimum can reach 12°C) (12). It is characterised by scanty rainfall (averaging 78mm per annum). The climatic diagram for the Doha area (Fig.1) drawn according to Walter (11) indicates high aridity. The major area of the Qatari Desert is less than 40m above sea level and most of it is flat or elevated land covered by stones and gravel. However, some localities are characterised by special physical and biotic features which qualify them as distinct desert habitats. Among these are surface depressions (named locally rodat) which receive run-off water, rich in silt and mud during the rainy season. They harbour dense vegetation compared with the surrounding desert. The commonest plant species are the trees *Ziziphus mummularia* (Burm.f.) Walk-arn. *Acacia tortilis* (Forssk.) Hayne and *Acacia ehrenbergiana* Hayne, and the shrub *Lyciuin Shawii* Roem. Et Schult. (12). The sand-dunes of the south west border of Qatar consist of deep sand deposits traversed by runnels and wadis. The plant community is dominated by *Panicum turgidum* forssk and *Hamada elegans* (Bunge) Bostch. The saline-flats (locally named sabkha) of Dukhan Ridge are covered with brine, and vegetation is restricted to the margins where salts are diluted with run-off rain water. These strips are dominated by *Halocnemum strobilolaceum* (Pall) M. Bieb (12).

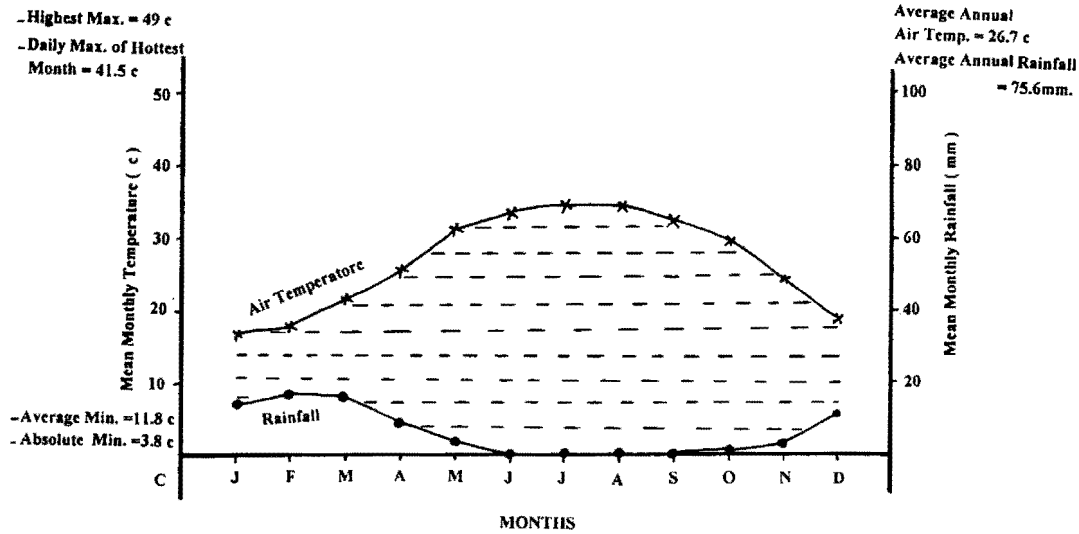

Fig 1: Climatic diagram for Doha area (1962-1990) based on the records of the Department of Meteorology, State of Qatar (The aridity for each month is indicated by the distance between air temperature and rainfall curves).

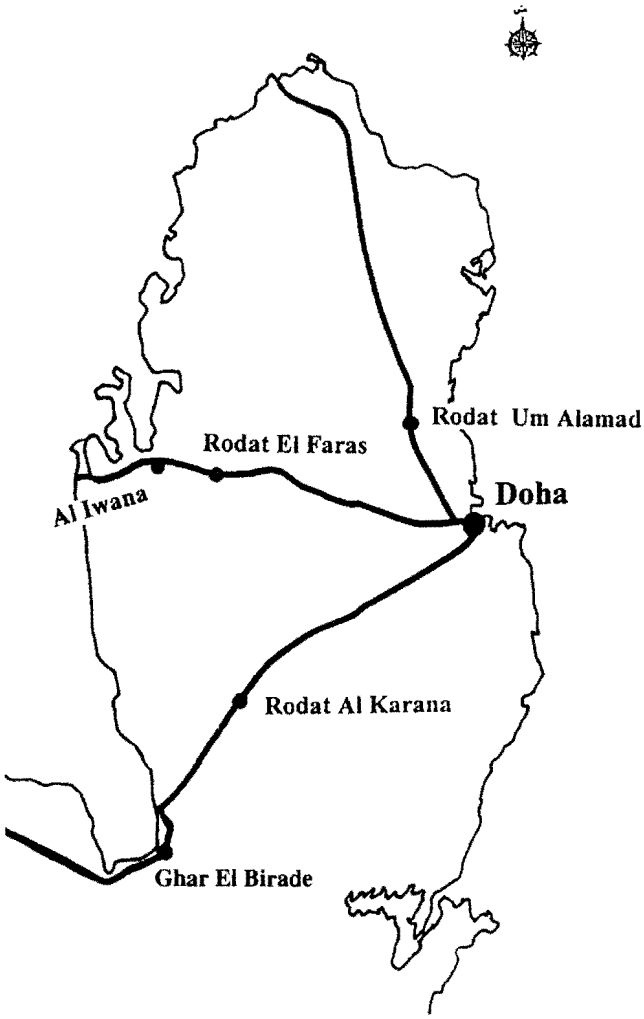

Fig 2: The map of Qatar, showing the study localities.

The present work represents a preliminary field investigation of the density and diversity of arthropods in selected localities in the Qatari Desert. It is hoped that the data collected will lead to a better understanding of the occurrence and distribution of this important animal taxon and form a base for further studies of the dynamics of the desert animal communities in Qatar.

STUDY AREA AND METHODS

Selected localities in the Qatari Desert were visited during two climatically different seasons in the years 1995, 1996 and 1997. The visits took place at the end of summer and beginning of autumn (October) in 1995, 1996 and in the spring (April) of 1996 and 1997. The mean climatic records for the two months are shown in Table (1).

The study localities as shown on the map (Fig.2) are in three different directions from Doha. They were selected on the basis of their ecologically distinctive nature. They include surface depressions (Rodat Um Alamad and Rodat Al Karaana), sand-dunes (Aar Elbirade) and saline-flats (Al Iwana).

The study areas were visited during the morning hours (09,00 to 12,00h) and at each locality the following parameters were measured: the temperature (using a Fisher Digital Thermometer) and relative humidity (using Taylor Sling Hydrometer) of the air, the soil temperature at 5-10 cm depth (using a Weksler soil thermometer) and wind speed (using a Dwyer anonometer). Soil moisture and organic matter content were estimated by drying and burning methods respectively. The salt-content of the soil was measured by means of a conductivity meter (YSI Model 33) while a digital pH meter (WPA, CD 330) was used to record soil pH.

Wooden quadrats (m^2) were used for random sampling of plants. Animals, especially arthropods, were collected by hand or by sweep-nets, within 100 m^2 quadrats. They were brought back to the laboratory for preservation and identification. Soil arthropods were extracted with Tullgren Funnels, Bearman Funnels and floatation in 25% zinic sulphate. Animals in rain pools were sampled with a fine bolting-silk aquatic net. For microscopic studies, animals were fixed in 70% or 90% ethyl alcohol, dehydrated in absolute alcohol, cleared in xylol and mounted in canada balsam.

Identification of the arthropods collected was based on published lists (7, 8, 13, 14, 15, 16) and general keys for identification (17, 18).

RESULTS

Records of physical parameters and plant biomass are shown in Table 2. These indicate that air temperature during the day was higher in all localities in October than in April, while the relative humidity of the air in all localities was higher during April than in October. Soil surface temperature was mostly higher than the air temperature. The soil profile differed in the three habitats: it was of the sandy-loam type (dominated by mud and silt) in *roda*, loamy sand (dominated by sand) in sand dunes, and in

sabkha the soil was dominated by mud and clay with a high salt-content. Soil moisture content was higher in samples taken in April than in October. The *sabkha* soil retained the greatest amounts. Soil organic content was greater in *roda* and sand-dunes in the samples taken in April. The plant biomass (gm/m2) of *roda* localities was higher compared with other sites, with the greatest recorded at Um Alamad in April 1996 as a result of a dense ephemeral plant cover.

It is evident that arthropods comprise the dominant animal taxon in all the study areas. Reptiles represented by the agamid *Uromastix microlepis*, the lizard *Acanthodactylus* sp., the gecko *Cyrtodactylus scaber*, the snake *Cerastes* sp. and *Varanus* sp. were encountered in small numbers. Few desert birds were seen and no mammals were recorded.

The arthropods collected were identified to the species level and listed in Table 3 (a, b, c, d, e, f, & g). The numbers of individuals collected within 100 m^2 quadrats, their relative density as percentages of the total numbers, and their diversity have been calculated. The Simpson's Index for diversity (D) was used according to the formula.

$$D = N(N-1)/\sum n(n-1)$$

Where (N) represents the total number of arthropods collected in the locality and (n) is the number per species.

The records indicate that the class Insecta was dominant both in relative density and in diversity in all the localities studied. However, in one case (the April collection at Rodat Um Alamad), the relative density of the isopod *Porcellio evansi* Omer-Cooper exceeded that of the insects in the area (Table, 3a).

Generally speaking, the average total arthopod number (N) collected (<100 per 100m2) and diversity (D<10) in the Qatari desert can be considered as low in comparison with records made in less arid deserts. Many of the insect species, especially those belonging to the orders Lepidoptera, Coleoptera and Hymenoptera were widely distributed and encountered in most of the localities studied. Nevertheless, some variations in distribution were recorded. The termite *Anacanthotermes ochraceus* (Barmeister) inhabited the sandy - loam soils of roda while *Psammotermes hybostoma* Desneux was restricted to sand-dunes. The conspicuous white-spotted carabid, *Thermophilum deudecimguttatum* (Bon.) was seen for the first time in Rodat Al Faras in April 1997, (Table 3, f).

The sand-dunes at Ghar Elbirade sustained a high arthropod diversity in both October and April (Table 3, b). However, the species relative density was lower in the sand-dunes than in the *roda*. The mud-flats proved to be the environment poorest in arthropod density and diversity, and the few species collected were restricted to the meagre plant community along the margins of the flats, (Table 3,e and g). The highest arthropod density was recorded in *roda* localities. These were also characterised by the highest plant biomass, the result of loam soil with high moisture and organic contents.

Soil microarthropods were either absent or very few in October samples. However, April samples from Rodat Um Alamad revealed a number of groups: The commonest Collembola represented by species belonging to two families; Reduvidae (10 individuals) and Isotomidae (2 individuals). Two species of oribatid mites and one species of pseudoscorpion were also encountered.

The temporary rainpools in the Alkaraana area contained a variety of aquatic arthropods. These in a 25 m2 pool included seven tadpole shrimps, *Triops granarius* (Lucas), 12 *Daphnia* sp., 20 coxid waterboatmen and five larvae of the mosquito *Cluex pepiens fatigans* Wied.

DISCUSSION

The differences in density and diversity of the arthropods recorded in various areas of Qatari desert are most probably due to edaphic and vegetational rather than to meteorological factors. It appears that local air temperature and relative humidity have only limited effect on arthropod occurrence and diversity. Then climatic factors may, however, have more effect on distribution and the selection of microhabitat.

Many of the flying insects limit their flight distribution and life cycle to particular shrubs or trees. A good example from the Qatari desert is afforded by the relation between the butterfly *Tarucas rosaeus* Austant and the tree *Z. mummularia*. The latter provides favourable microclimates and rich food resources. The distribution of isopods and many surface-active arthropods is strongly affected by the presence of stone cover. This has also been reported by Kheirallah (19).

It is evident that orientation and functional organisation of desert arthropods are influenced by temporal use of habitat explained by responses to surrounding solar radiation, temperature, humidity and wind speed. These conditions, as indicated by Crawford (6), are related to the physiological adaptation of desert arthropods.

It has been shown in many case — studies that different habitats in any given desert region are populated by qualitatively distinct assemblages of arthropods (20, 21, 22). This conclusion has been qualified by the present investigation. Furthermore, it was postulated by Crawford (6) that the factors that affect the vegetation may also strongly influence arthropod population patterns. Seasonal variation in arthropod activity has in some instances been correlated with rainfall (19, 23). The present study has shown that seasonal precipitation, which resulted in an increase of arthropod density in some land depressions *(roda)* did not result in an increase in diversity. It is probable that soil texture and its water related qualities are among the most important abiotic factors affecting density and diversity of surface active arthropods. This has been illustrated by a number of studies (20, 21, 24).

It can be concluded that the Qatari desert, though comparatively small, embodies various distinct localised habitats. These support diverse assemblages of arthropods. These constitute the bulk of the animal biomass. The role played by arthropods in energy transfer and the recycling of soil organic material is most probably a major factor in the functioning and overall balance of this delicate ecosystem. The present preliminary investigation represents an initiative for further comprehensive studies.

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Table (1) : Mean macroclimatic records at Doha airport October and April (source: Department of Civil Aviation & Meteorology, State of Qatar)

Season	October	April	Number of averaged years
	End of dry season & beginning of autumn	Second month	
Mean air Temperature	29.9°C	25.8°C	33 yrs.
Highest recorded temperature	4.3°C	46°C	33 yrs.
Lowest recorded temperature	16.6°C	10.5°C	33 yrs.
Mean relative humidity	63%	53%	21 yrs.
Lowest recorded relative humidity	8%	6%	21 yrs.
Mean Wind speed	7.2kt	9.1kt	21 yrs.
Highest recorded rainfall	17.3kt	68.1mm	33 yrs.

Table 2 : Physical parameters and plant biomass in the study localities indicated in Fig. 1

locality	Date of visit	Time of day (hr)	Air temp. °C	% RH	Soil temp. °C (5-10 cmd.)	Soil type	Soil moisture content	Soil organic matter content	Soil pH	Soil salt content	Wind speed m/hr	Plant biomass g/M
Rodat UMALAMAD	27-10-95	09:30	30	55	35	sandy loam	0.72 %	0.68 %	7	0.12 %	2	42
	11 -4 -96	10:25	23	58	25	sandy loam	3.42 %	3.6 %	7	0.11 %	10-20	92
Rodat ALKARANA	14 -10 - 96	09:20	25.6	60	26.7	sandy loam	0.48 %	0.7	7	0.09 %	2	40.5
GHAR ELBIRADE (sand dunes)	11- 4 - 96	10:15	29	72	32	loamy sand	2.5 %	2.2	7	0.17 %	50	37
Rodat ALFARAS	17- 10- 96	11:30	34.4	30	34	sandy loam	0.78 %	6.63 %	7.5	0.28 %	< 2	48
ALIWANA (*Sabkha*)	17- 10- 96	09:00	31.7	44	33.3	salty mud	7.4 %	0..84 %	8.06	3.94 %	5	22
Rodat ALFARAS	3 - 4 - 97	10:00	24	50	26	sandy loam	5 %	0.91 %	8.06	0.3	30	92
ALIWANA (*Sabkha*)	3 - 4 - 97	11:30	25	45	26.5	salty mud	3.76 %	0.09 %	8.69	2.49	20	54

Table 3-a : Arthropod collection from Rodat " UM ALAMAD " in October 1995, (n= number of individuals of each species and N= total number collected)

Class	Order	Family	Species	Number collected (n/100m2)	Relative density n/N X100	Diversity (D=Simpson Index)
Arachnida	Scorpionida	Scorpionidae	*Androctonus grassicauda* (Ohv.)	3	3.83	
Arachnida	Araneae	Gnathophosidae	*Zelotes simplex obscarior* (Denis)	2	2.56	
Arachnida	Araneae	Thomisidae	*Philoronus* spp.	2	2.56	
Insecta	Isoptera	Hodotermidae	*Anacanthotermes ochraceus* (Burmesister)	15 (workers)	19.23*	6.673
Insecta	Orthoptera	Gryllidae	*Acheta domistica* L.	1	1.28	
Insecta	Orthoptera	Acrididae	*Truxalis* sp.	2	2.56	
Insecta	Neuroptera	Myrmeleontidae	*Greleon* sp.	5 (larvae)	6.41	
Insecta	Lepidoptera	Pieridae	*Anaphaeis aurata* (Fab.)	2	2.56	
Insecta	Lepidoptera	Pieridae	*Tarucus rosacus* (Austant)	12	15.38	
Insecta	Coleoptera	Tenebrionidae	*Adesmia cancelata* (L.)	22	28.2**	
Insecta	Coleoptera	Tenebrionidae	*Trachyderma (Ocnera) hispida* (Forsk)	7	8.97	
Insecta	Hymenoptera	Formicidae	*Cataglyphis niger* L.	N = 78	6.41	

** : Most dominant ; * : Second dominant .

Table 3-a (cont.) Arthropods collected from Rodat Um Alamad in April 1996.

Class	Order	Family	Species	Number collected (n / 100M2)	Relative density n/N X100	Diversity (D)=Simpson Index
Crustacea	Isoptera	Oniscidea	*Porcellio evasi* (Omer Cooper)	52	56.52**	
Chilopoda	Scolopendr-omorpha	-	*Trachycomocephalus mirabilis* (Porat.) *{ Scolopendra trucatipes (Poc.) }*	6	6.52	
Insecta	Thysanura	Lepismidae	*Thermobia domistica* (Pachart)	4	4.34	2.81
Insecta	Coleoptera	Carabidae	*Callosoma imbricata*	11	11.95	
Insecta	Coleoptera	Darmestidae	*Deremestes* spp.	7	7.60	
Insecta	Coleoptera	Coccinellidae	*Coccinellidae septmpunctata* L.	12	13.04*	
				N = 92		

Table 3 - b : Arthropods collected from GHAR ELBIRADE Sand-dunes in October 1995.

Class	Order	Family	Species	Number collected (n / 100M2)	Relative density n/N X 100	Diversity (D)=Simpson Index
Arachnia	Scorpionda	Scorpiondae	*Androctonus grassicaudis*(Oliv.)	2 (nymphs)		
Arachnia	Araneae	Lycosidae	*Lycosa* spp.	2	3.8	
Arachnia	Aeari	Ixodidae	*Hylomma impeltum* (Schultze & Schlottke)	4	3.8	
Insecta	Orthoptera	Acrididae	*Anacridium melanorhoden* (Dirsh)	3	7.69	
Insecta	Isoptera	Rhinotermitidae	*Psammotermes hybostoma* (Desneuk)	10 (workers)	5.76	
Insecta	Hemiptera	Pentatomidae	*Nazara virdula* (L.)	12	19.2	
Insecta	Diptera	Chaliphoridae	*Chrysommya albiceps* (Weidemann)	3	32	
Insecta	Coleoptera	Scarabidae	*Searabaeus sacer anticollis* (Motschulsky)	4	7.69	6.67
Insecta	Coleoptera	Tenebrionidae	*Adeemia cancellata* L.	2	3.8	
Insecta	Coleoptera	Tenebrionidae	*Blaps mortisaga* Sol.	1	1.9	
Insecta	Coleoptera	Tenebrionidae	*Pimelia arabica* Klug	2	3.8	
Insecta	Coleoptera	Tenebrionidae	*Priontheca coronata* (Oliver)	2	3.8	
Insecta	Coleoptera	Tenebrionidae	*Trachyderma* (Ocnera) hispida Forsk	3	5.76	
Insecta	Coleoptera	Tenebrionidae	*Aris elevata* (Solier)	1	1.9	
Insecta	Coleoptera	Tenebrionidae	*Zophosis* spp.	1 N = 52	1.9	

Table 3 -b (cont.) . Arthropod collection from GHAR ELBIRADE Sand-dunes in April 1996.

Class	Order	Family	Species	Number collected (n/ 100M2)	Relative density n/N X100	Diversity (D) = Simpson Index
Insecta	Orthoptera	Acrididae	*Pyrgomorpha conica-bispinosa* (Hsiung & Kevan)	3	27.27*	
Insecta	Orthoptera	Acrididae	*Truxallis grandis (* Klug)	1	9.09	
Insecta	Orthoptera	Acrididae	*Locusta migratoria*	3 (nymphes)	27.27*	9.16
Insecta	Hemiptera	Lygaedae	*Dieuches armipes* (Fab.)	1	9.09	
Insecta	Diptera	Asilidae	*Apoclea femoralis* (Wiedemann)	1	9.09	
Insecta	Diptera	Syrphidae	*Eumerus taremenorium*	1	9.09	
Insecta	Coleoptera	Cicindelidae	*Cicindela memoralis* (Oliv.)	1 N = 20	9.09	

Table 3-c : Arthropod collection from Rodat"ALKARANA "in April 1996.

Class	Order	Family	Species	Number collected (n / 100M2)	Relative density n/N X 100	Diversity (D)=Simpson Index
Insecta	Coleoptera	Carabidae	*Calosoma Deserticola* (Sem.)	6	30**	
Insecta	Coleoptera	Tenebrconidae	*Adesmia cancellata* L.	2	10	
Insecta	Coleoptera	Tenebrconidae	*Pimelia intervallarids* (Kaszab)	1	5	
Insecta	Coleoptera	Tenebrconidae	*Mesostena arabica* (Gestro)	1	5	
Insecta	Coleoptera	Dermesitidae	*Dermestis frischi* (Kugelann)	1	5	7.5
Insecta	Coleoptera	Meliodae	*Cylidrothorax buettikere* (Kaszab)	1	5	
Insecta	Coleoptera	Hydrophilidae	*Laccabius* spp.	1	5	
Insecta	Lepidoptera	Sphingidae	*Dophnis nerii* (L .)	1	5	
Insecta	Hymenoptera	Formicidae	*Monmorium pharaonsis* (L.)	1	25*	
Insecta	Hymenoptera	Pompilidae	*Stolidia noscibilis* (Pallas)	1 N = 20	5	

Table 3-d : Arthropod collection from Rodat Alfaras in October 1995.

Class	Order	Family	Species	Number collected (n /100M2)	Relative density n/N X 100	Diversity (D)=Simpson Index
Insecta	Thysanura	Lepismidae	*Thermobia domistica* (Packard)	10	21.73*	
Insecta	Orthoptera	Acrididae	*Truxallis nasutata* (L.)	2	4.34	
Insecta	Neuroptera	Myrmeleontidae	*Greleon* spp.	5	10.86	
Insecta	Lepidoptera	Pieridae	*Tarucus rosaeus* (Austand)	20	40.81**	3.95
Insecta	Coleoptera	Tenebrionidae	*Trachyderm (Ocnera) hispida* (Forsk)	4	8.69	
Insecta	Coleoptera	Tenebrionidae	*Adesmia cancellata* (L.)	5 N = 46	10.86	

Table 3 -e : Arthropod collection from " Sabkhat ALIWANA ", in October 1995

Class	Order	Family	Species	Number collected (n / 100M2)	Relative density n/N X 100	Diversity (D)=Simpson Index
Insecta	Thysanura	Lepismidae	*Thermobia domistica* (Packard)	4	44.4**	
Insecta	Dictyoptera	Mantidae	*Empusa pennata* (Thunberg)	1	11	
Insecta	Orthoptera	Acrididae	*Truxallis* spp.	1	11	6.00
Insecta	Orthoptera	Acrididae	*Conocephlus* spp.	1	11	
Insecta	Orthoptera	Acrididae	*Sphinognatus* spp.	1	11	
Insecta	Coleoptera	Tenebrionidae	*Trachyderma (Ocnera) hispida* (Forsk)	1 N = 9	11	

Table 3-f: Arthropod collection from "Rodat Al Faras" in April 1997

Class	Order	Family	Species	Number collected (n / 100M2)	Relative density n/N X 100	Diversity (D)=Simpson Index
Crustacea	Isoptera	Oniscidea	*Porcellio evansi* (Omer-Cooper)	11	16	
Chilopoda	Scolopendr-morpha	Oniscidea	*Trachycomocephalus mirabilis*(Porat) *{Scolopendra trucatipes* (Poc.) *}*	3	4.4	
Arachnida	Araneae	Lycosidae	*Lycosa* spp.	2	2.9	
Insecta	Thysanura	Lepismidae	*Thermobia domistica* (Packard)	12	17.6*	
Insecta	Orthoptera	Acrididae	Unidentified nymphs	5	7.3	8.5
Insecta	Lepidoptera	Pieridae	*Tarucus rosaes* (Austand)	2	2.9	
Insecta	Lepidoptera	Pieridae	*Tarucus* spp.	2	2.9	
Insecta	Coleoptera	Carabidae	*Thermophilum duodeciumguttatum* (Bon.)	4	5.8	
Insecta	Coleoptera	Tenebiconidae	*Adesmia cancellata* (L.)	16	23.5**	
Insecta	Coleoptera	Tenebiconidae	*Mesostina arabica* (Gestro.)	5	7.3	
Insecta	Coleoptera	Tenebiconidae	*Erodius* spp.	3 N = 68	4.4	

Table 3 -g : Arthropod collection from " Sabkhat Al Iwana" in April 1997

Class	Order	Family	Species	Number collected (n /100M2)	Relative density n/N X 100	Diversity (D)=Simpson Index
Arachnia	Araneae	Gnathophosidae	*Zelotes simplex obscurior* (Denis)	2	16.6*	
Insecta	Thysanura	Lepismidae	*Thermobia* spp.	3	25	
Insecta	Orthoptera	Acrididae	*Anacridium melanorhodern* (Denish)	1	8.3	4.7
Insecta	Coleoptera	Carabidae	*Thermophilum duodecimguttaum*(Bon.)	1	8.3	
Insecta	Coleoptera	Tenebrionidae	*Adesmia clathrata* (Sol.)	5 N = 12	41.6**	