Al-Mukhtar Journal of Sciences 33 (4): 281-289, 2018

Biodiversity, Abundance and Seasonal Fluctuation of Ground Beetles on Massa Region

Eman M A. Belhassan, Ali A. Bataw* and Mansour Salem A. Attia
Department of Zoology, Faculty of Science, Omar AL-Mukthar University, Al-Bayda- Libya

Received: 9 May 2018 / Accepted: 6 December 2018
Doi: https://doi.org/10.54172/mjsc.v33i4.296

Abstract: The present study was carried out to investigate the biodiversity, abundance and seasonal fluctuation of ground beetles on Massa region from June 2015 to October 2016. The beetles were collected using 20 pitfall traps which were operated on a weekly basis, a total of 2867 specimen representing two families Carabidiae and Tenbrionidae and 10 genera (*Blaps polychresta*, *Zophosis punctata*, *Pimelia interpunctata*, *Blaps nitens*, *Adesmia dilatata*, *Scaurus vicinus*, *Tentyria cyrenaica*, *Laemostenus complanatus*, *Ditomus cilpeatun* and *Akis costitubera* were recorded. Overall diversity was 81% and 83% Simpson's scale and Shannon's scale respectively. The highest index; 0.116841 (Simpson's index) and 0.36693 (Shannon's index) was found in species *Z. punctata*. Results showed the influence of temperature on *A. costitubera, B. polychresta* and *D. cilpeatun* with the *A. costitubera* being a better predictor, addition to constant of *A. costitubera* Beta =0.818 ; constant of *A. costitubera and B. polychresta* Beta = 0.625 and 0.53 and constant of *A. costitubera , B. polychresta* and *D. cilpeatun* Beta = 0.629 , 0.335 and 0.191. The results concluded the importance of using ecological indexes in studying the abundance and seasonality of ground beetles fluctuated during different seasons.

Keywords: Ground beetle, Biodiversity, Abundance, seasonal fluctuation.

INTRODUCTION

Beetles are endopterygotes; they undergo complete metamorphosis, a biological process by which an animal physically develops after a birth or hatching, undergoing a series of conspicuous and relatively abrupt changes in its body structure. Males may fight for females in various ways, and such species tend to display marked sexual dimorphism. Beetles play an important role in ecosystems. Prominent epigeal examples are the Tenebrionidae that play an important role as primary Decomposers (J. R. Henschel, Grohmann, Siteketa, & Linsenmair, 2010). Different beetles are beneficial for us, Carrion beetles feed on dead and decaying material and help in decomposition cycle. Scientific literature on beetles of Pakistan already reported by (Rafi et al., 2010) on tiger beetle,(Sultan et al., 2008) on tortoise beetle, (Darilmaz & Ahmed, 2009) on (Coleoptera: Dytiscidae). Soil beetles may play important roles in the ecosystem through their activities as predators, herbivores, and scavengers (Brussaard, 1997).

Herbivorous beetles may cause crop damage and yield loss while, in contrast, predatory beetles can perform as biological control agents against the crop pests (Kalshoven, 1981). Scavenger beetles comminute and decompose soil organic matters. In agroecosystems, beetles are often exposed to soil tillage, chemical pesticide, inorganic fertiliz-

***Corresponding Author:** Ali. A. Bataw alibataw1957@gmail.com Faculty of Science, Omar Al-Mukhtar University, Al-Bayda- Libya

er applications, and monoculture planting system. Tillage could damage beetle micro niches and foraging sites while insecticide could toxify them. Meanwhile, monoculture system could in one hand limit food access for a number of species but on the other hand allow excessive exploitation for only few other species of herbivorous beetles. In Libya, there is not much detailed information about Coleoptera in El-Jabal Alakhdar and their diversity and abundance. Thus, the objectives of this study were to investigate beetles population diversity in Massa region, recognition of seasonal fluctuation, and describe the abundance of species and its relationship in the community by using diversity indices.

MATERIALS AND METHODS

Study site

The site of study is an area of 10 hectares located very close to Massa region, which is located in the west of Al-Bayda city (Libya) between latitude 32°45' north and longitudes 21° 37' east, and at an altitude of 495 meters above sea level. The area is characterized with forest trees such as, *Cupressus sempervirens* L., *Ceratonia siliqua* L., *Pistacia lentiscus* L., *Phillyrea latifolia* L., *Arbutus pavarii, Olea europaea* (hoffimg&link), *Rhamnus lycioides* L. Jahandez, *Erica multiflora* L., *Globularia alypum* linn., *Cistus parviflorus* Lam. And *Calicotome villosa* (Poir.) link.

Sampling

The studies were performed between June 2015 and October 2016. In 2015, the collection of beetles started from June until October, and in 2016 started from April and until October, where there is an activity of beetles. About 20 pitfall traps were used in the site separated by 10 m distance, and checked once a week. Each trap was a glass cup of 8 cm in diameter and 15cm in depth with a small amount of soil in the bottom filled with bait to attract the insects. The collected specimen killed by using Ethel acetate. Collected specimens were identified by labels and according to field data, and separated to different taxa to count the number of each species caught.

Biodiversity index

Shannon and Simpson biodiversity indices were used to assess the habitat preference of the ground beetles. α-diversity (The diversity of species within a community or habitat). **Simpson's index:** $D=\Sigma\ pi^2$, **Shannon's indices of diversity and evenness:** $H'= -\Sigma\ (Pi\ In\ Pi)$, **Equitability or evenness:** $H'/\ In\ S$. where, D= diversity measure, S= number of species, p_i= proportion of individuals belonging to species.

Statistical analysis

One way ANOVA was used to analyze data to determine differences in beetle abundance ($P<0.005$). If ANOVA results showed significant differences, mean numbers were separated by Tukey's Protected Least Significant Differences (LSD, $P < 0.05$). *t*-Test was used to compare between the mean numbers of abundance of species among the years 2015 and 2016. Analysis was run on a SPSS Statistical package programme (SPSS Version 17).

RESULTS

A total of 2867 specimens of beetles representing two families were captured by pitfall traps in Massa region and identified during the two sampling years 2015-2016. Tenebrionidae beetles formed the dominant group in our investigation, comprising 93.8% of all individuals, whereas Carabid beetles and other Coleoptera formed 6.2% of all individuals (Table 1). The beetles collected by pitfall traps were: *Blaps polychresta* (Forskd 1775), *Zophosis punctuate* Brulle 1832, *Pimelia interpunctata* kluy 1830, *Blaps nitens* Laporte de catelenau 1884 , *Adesmia dilatata* (Klug 1830), *Scaurus vicinus* Solire 1838,*Tentyria cyrenaica* Schuster 1919, *Laemostenus complanatus* (Dejean 1828), *Ditomus cilpeatun* Bonelli 1810 and *Akis costitubera* Marseul 1883. The species *Zophosis punctate* recorded the highest number of all collection (34%). Followed by the species *Akis costitubera* (18.52), *Tentyria Cyrenaica* (13.32), and *Blaps polychresta* with

ISSN: online 2617-2186 print 2617-2178

(9.034%).

Table (1). Overall abundance of beetle species collected by pitfall traps in Massa region through the years 2015 and 2016.

Species	No. of individuals	%
Tenebrionidea		
Blaps polychresta (Forskd 1775)	259	9.0338
Zophosis punctuate Brulle 1832	981	34.182
Pimelia interpunctata kluy 1830	120	4.1856
Blaps nitens Laporte de catelenau 1884	196	6.8364
Adesmia dilatata (Klug 1830)	70	2.4416
Scaurus vicinus Solire 1838	151	5.2668
Tentyria cyrenaica Schuster 1919	382	13.324
Akis costitubera Marseul 1883	531	18.521
Carabidae		93.791
Laemostenus complanatus (Dejean1828)	149	5.1971
Ditomus cilpeatun Bonelli 1810	29	1.0115
		6.2086

The Beetles abundance during the year 2015

The analysis of Varian's at (P<0.005) of data collected during 2015 revealed significant differences in their abundance in each month of the following species: *Zophosis punctuate, Pimelia interpunctata*, *Blaps nitens*, *Adesmia dilatata*, *Akis costitubera* and *Laemostenus complanatus,* and their activities recorded fluctuation in their numbers from one month to another. While the species belonging to *Blaps polychresta***,** *Scaurus vicinus*, *Tentyria cyrenaica***,** and *Ditomus cilpeatun* showed no significances in their abundance between the months and all species showed significant differences in their numbers through each month.

The Beetles abundance during the year 2016

The analysis of Varian's at P<0.005 of data collected during 2016 revealed significant differences in their abundance between the months recorded, the species *Zophosis punctuate***,** *Pimelia interpunctata*, *Blaps niten, Adesmia dilatata*, *Scaurus vicinus***,** *Akis costitubera* and *Ditomus cilpeatun,* and their activities recorded fluctuation in their numbers from one month to another. While the species belonging to *Blaps polychresta, Tentyria cyrenaica, Laemostenus complanatus* showed no significances in their abundance between the months, and the species showed significant differences in their numbers in May, June, July, and September and no significant differences in their abundance through April and October.

T-test analysis to compare the abundance of species of Coleoptera during 2015-2016

The t-test analysis was used to compare between the mean number of individuals during the years 2015 and 2016, and thus had been compared to every species over the two years period. We found that *Blaps polychresta* had no significant differences in abundance between the years (P = 0.612), while *Zophosis punctate* showed significant differences in abundance (P = 0.006), where the mean collected beetles (34.71) during the 2016 was higher than (0.45) in 2015. *Pimelia interpunctata* showed no significant differences in the number of species between the years (P = 0.595). *Blaps nitens* showed differences in abundance through the years of collection (P = 0.015), where the mean individual (5.39) during the year 2016 was higher than the average sample (2.25) in 2015. The results showed no significant differences in the abundance of species *Adesmia dilatata* through the two years (P < 0.309), *Scaurus vicinus* recorded significant differences in the abundance of species between the two years (P = 0.007), where the sample mean (5.07) during 2016 was higher than the average sample (0.45) in 2015. The species *Tentyria cyrenaica* showed significant differences in the abundance of species between the years (P = 0.005), where the mean collected sample (12.79) during 2016 was higher than the average sample (1.20) in 2015, *Laemostenus complanatu* recorded significant differences in the abundance of species between the two years (P = 0.022), where the sample mean (4.75) during the year 2015 was higher than the sample mean (1.93) during the year 2016. The species *Ditomus*

ISSN: online 2617-2186 print 2617-2178

cilpeatun recorded no significant differences in the abundance through the two years (P = 0.678), also the species *Akis costitubera* recorded no significant differences in the abundance of species between the two years (P = 0.125).

Table (2). T-test analysis to compare the abundance of species of Coleoptera during 2015-2016

Species	Year	N	Mean	Std. Dev.	S.E Mean	t-test	P<0.05
Blaps polychresta	2015	20	4.90	3.227	0.721	-0.511	0.612
	2016	28	5.75	6.899	1.304		
Zophosis punctate	2015	20	0.45	0.826	0.185	-2.893	0.006
	2016	28	34.71	52.792	9.977		
Pimelia interpunctata	2015	20	2.15	3.498	0.782	-0.535	0.595
	2016	28	2.75	4.043	0.764		
Blaps nitens	2015	20	2.25	2.918	0.652	-2.533	0.015
	2016	28	5.39	4.962	0.938		
Adesmia dilatata	2015	20	0.95	1.572	0.352	-1.029	0.309
	2016	28	1.82	3.539	0.669		
Scaurus Vicinus	2015	20	0.45	1.395	0.312	-2.834	0.007
	2016	28	5.07	7.175	1.356		
Tentyria cyrenaica	2015	20	1.20	2.648	0.592	-3.837	0.000
	2016	28	12.79	13.276	2.509		
Laemostenus complanatus	2015	20	4.75	3.447	0.771	2.362	0.022
	2016	28	1.93	4.472	0.845		
Ditomus cilpeatun	2015	20	0.45	1.234	0.276	-0.418	0.678
	2016	28	0.71	2.623	0.496		
Akis costitubera	2015	20	9.00	5.400	1.207	-1.563	0.125
	2016	28	12.54	9.012	1.703		

The mean difference is significant at the 0.05 level.

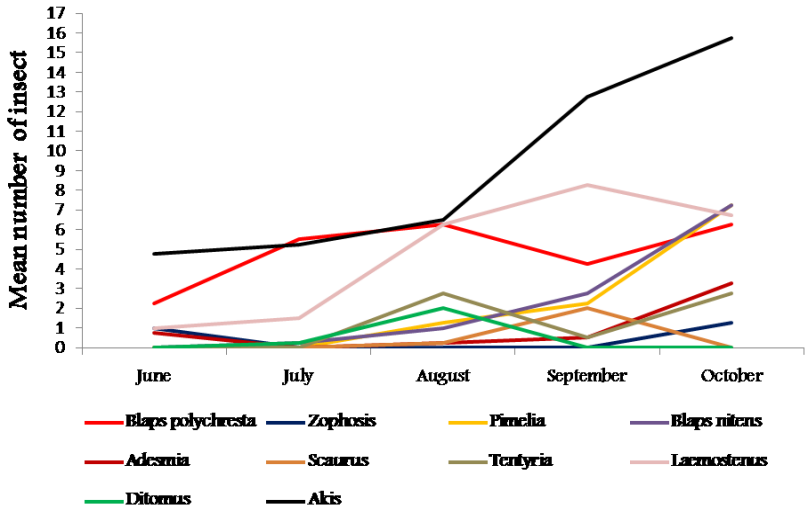

Figure (1). Seasonal abundance of dominant Coleoptera species during the season 2015

ISSN: online 2617-2186 print 2617-2178

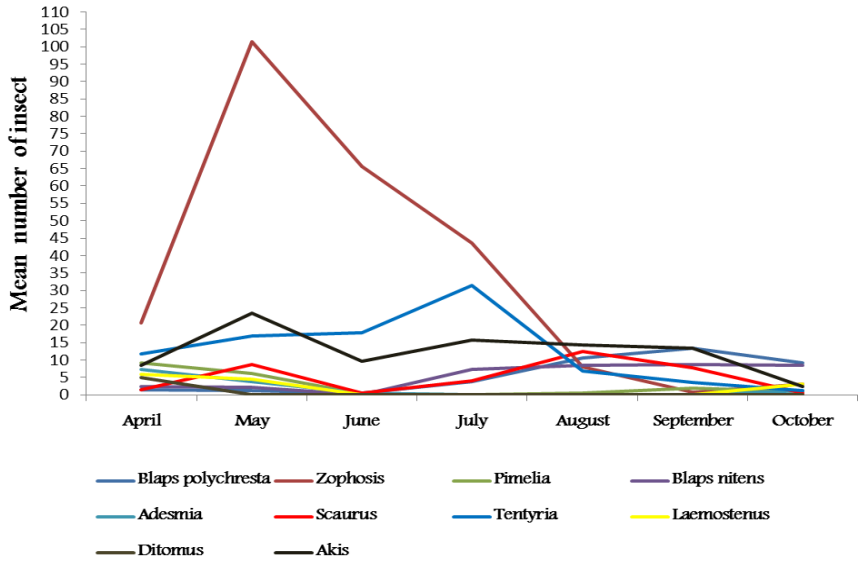

Figure (2). Seasonal abundance of dominant Coleoptera species during the season 2016

Measuring abundance species by using diversity index: The overall diversity of beetles worked out on the basis of the number of beetles using (Simpson, 1949) equation index of dominance, a value of 0.189657 was obtained for beetles communities in the study area from Massa site (Table 4). The Shannon's index value of 1.92708 was obtained. *Zophosis punctala* with values of 0.116841 (Simpson's index) and 0.36693 (Shannon's index) was the dominant species. The overall beetles diversity (1-D= 0.810342581) on Simpson's scale was 81% and on the Shannon's scale (H / ln S=0.83692) is 83 %(Table 23).

Table (4). Diversity indices of individual numbers of different beetle species (2015/2016).

Species	Total Abundance	Percentage%	Pi	Pi^2 Simpson's	Pi^2 (ln Pi) Shannon's
Blaps polychresta	259	9.033833	0.090338	0.008161	-0.21719
Zophosis punctala	980	34.18207	0.341821	0.116841	-0.36693
Pimelia interpuntata	120	4.18556	0.041856	0.001752	-0.13283
Blaps nitens	196	6.836414	0.068364	0.004674	-0.18341
Adesmia dilatata	70	2.441577	0.024416	0.000596	-0.09064
Scaurus vicinus	151	5.266829	0.052668	0.002774	-0.15504
Tentyria cyrenaica	382	13.32403	0.13324	0.017753	-0.26856
Laemostenus complatus	149	5.19707	0.051971	0.002701	-0.15368
Ditomus cilpeatun	29	1.01151	0.010115	0.000102	-0.04647
Akis costitubera	531	18.5211	0.185211	0.034303	-0.31231
Total	2867			D=0.189657 1-D= 0.810342581	H =1.92708

D=diversity measure,p_i= proportion of individuals belonging to species $_i$, p_i^2=Square p_i

ISSN: online 2617-2186 print 2617-2178

Multiple Regressions according to independent variables:

To investigate the contribution of the dependent variable; temperature effects on the prediction of the *Blaps polychresta, Zophosis, Pimelia, Blaps Adesmia, Scaurus, Tentyria, Laemostenus, Ditomus* and *Akis,* a multiple stepwise regression method was used.

Table (5). Stepwise Regression for Independent Variables and the temperature Scores

Model	Unstandardised Coffi.		Standardised Coffi.	T	P<0.05
	B	Std. Error	Beta		
1- *(Constant)*	1.445	.1480	.8180	9.761	.000
Akis costitubera					
2- *(Constant)*	1.104	.1540	.6250	7.182	.000
Akis costitubera and Blaps polychresta	1.085	.2680	.3520	4.051	.000
3- *(Constant)*	1.111	.1430	.6290	7.753	.000
Akis costitubera ,	1.032	.2500	.3350	4.123	.000
Blaps polychresta and Ditomus cilpeatun	2.072	.7370	.1910	2.810	.007

Model Summary

Model	R	R Square	Adjusted R Square	Stand.Error of Estimate
1- *Akis costitubera*	.8180	.6700	.6630	13.865
2- *Akis costitubera and Blaps polychresta*	.8700	.7570	.7460	12.032
3- *Akis costitubera, Blaps polychresta and Ditomus cilpeatun.*	.8900	.7930	.7790	11.220

Results showed the influences of temperature on *Akis costitubera, Blaps polychresta* and *Ditomus cilpeatun.* with the *Akis costitubera* being a better predictor, in addition to constant of *Akiscostitubera* Beta =0.818 ; (P< 0.05) constant of *Akis costitubera and Blaps polychresta* Beta = 0.625 and 0.53(P< 0.05) and constant of *Akis costitubera , Blaps polychresta* and *Ditomus cilpeatun* Beta = 0.629 , 0.335 and 0.191 (P<0.05) .

DISCUSSION

The number of invertebrates species collected by pitfall trap in any habitat is well correlated not only with species abundance but also with activity (Aldryhim, Mills, & Aldawood, 1992; Saji & Al Dhaheri, 2011). The pitfall traps have been considered as a reliable method for beetles and long-term trapping is required to understand the biodiversity, community composition, and the activity of different species in different climatic conditions (J. Henschel, Mtuleni, Pallett, & Seely, 2003).

The present study shows for the first time the species abundance distribution of the beetle faunal diversity in Massa region. 2867 specimens of beetles representing two families were captured by pitfall trap in Massa region, and identified during the two sampling years 2015-2016. Tenebrionidae beetle formed the dominant group in our investigation, comprising 93.8% of all individuals, whereas Carabid beetles and other Coleoptera formed 6.2% of all individuals (Table 1). This was a two-year study and long-term inferences may not be reliable. However, our results suggest that extent of dispersal alone may not determine population abundance of ground beetles in habitats. Other factors such as variation in soil properties, micro- and macroclimatic conditions, intra- and interspecific competition, predation and parasitism, and chemical and cultural treatment of the land (e.g., pesticide use and

ISSN: online 2617-2186 print 2617-2178

tillage practices) probably affect ground beetle populations over time, Tenebrionidae and Carabidae are important groups in ecological researches. They show clear associations with environmental parameters such as soil type and vegetation cover and are thus good indicators of environmental change (Gardner, 1991; Koivula, 2011). The number of beetles collected by pitfall traps on Massa site was high in October of 2015 (202 samples) whereas in 2016 the number was high during the month of May (675 samples).

Annual variation in the number of ground beetle species and their abundances may be expected in both temporary and permanent (Den Boer, 1986; Luff, 1990). However, in this study, the overall capture rate of ground beetles was quite similar between years in the species diversity. Some species may have highly restricted activity periods, whereas others may extend their activity over several weeks or months (Koivula, 2011; Stork, 1990)

The analysis of Varian's at ($P<0.005$) of data collected during 2015 revealed significant differences in beetles abundance in each month for the following species: *Zophosis punctuate, Pimelia interpunctata*, *Blaps nitens*, *Adesmia dilatata*, *Akis costitubera* and *Laemostenus complanatus,* and their activities recorded a fluctuation in their numbers from one month to another. While the species belonging to *Blaps polychrest***,** *Scaurus vicinus*, *Tentyria cyrenaica***,** and *Ditomus cilpeatun* showed no significances in their abundance between the months, and all species showed significant differences in their numbers through each month. The analysis of Varian's at $P<0.005$ of data collected during 2016 revealed significant differences in their abundance between the month, and were recorded in the species *Zophosis punctuate***,** *Pimelia interpunctata*, *Blaps niten, Adesmia dilatata*, *Scaurus vicinus***,** *Akis costitubera* and *Ditomus cilpeatun,* and their activities recorded fluctuation in the numbers from one month to another. While the species belonging to *Blaps polychresta, Tentyria cyrenaica, Laemostenus complanatus* showed no significances in their abundance between different months, and the species showed significant differences in their numbers in May, July and September and no significant differences in their abundance through April and October. Beetle species behavior in different months suggests that the population of various species depends upon a favorable environment, including high-quality food resources and the weather (Seastedt & Crossley Jr, 1983). The beetles showed a rich faunal diversity in Massa area, and the present study may help in the conservation of beetles and their habitats in El-Jabal Alakhdar regions.

The study shows the habitat-specific occu rence of beetles, which may be due to food preferences, etc. That means the Massa based soil system was highly conducive to the survival of beetles. The family Tenebrionida*e* was represented by the heights number of species. Environmental parameters regulate the distribution of Tenebrionidae beetles (Colombini, Fallaci, & Chelazzi, 2005). The representatives of Tenebrionidae presented the maximum diversity of species and contributed to the highest (93.791%) faunistic composition, followed by Carabidae (6.2086%). The results concluded the importance of using ecological indexes in studying the abundance and seasonality of ground beetles fluctuated during different seasons.

REFERENCES

Aldryhim, Y. N., Mills, C., & Aldawood, A. (1992). Ecological distribution and seasonality of darkling beetles (Coleoptera: Tenebrionidae) in the central region of Saudi Arabia. *Journal of arid environments, 23*, 415-415.

Brussaard, L. (1997). Biodiversity and ecosystem functioning in soil. *Ambio*, 563-570.

ISSN: online 2617-2186 print 2617-2178

Colombini, I., Fallaci, M., & Chelazzi, L. (2005). Micro-scale distribution of some arthropods inhabiting a Mediterranean sandy beach in relation to environmental parameters. *Acta Oecologica, 28*(3), 249-265.

Darilmaz, M. C., & Ahmed, Z. (2009). A new record for the fauna of Pakistan: Hydaticus leander (Rossi, 1790)(Coleoptera: Dytiscidae). *Turkish Journal of Zoology, 33*(1), 105-106.

Den Boer, P. (1986). What can carabid beetles tell us about dynamics of populations. *Carabid Beetles. Their Adaptions and Dynamics. Gustav Fischer, Stuttgart, New York*.

Gardner, S. M. (1991). Ground beetle (Coleoptera: Carabidae) communities on upland heath and their association with heathland flora. *Journal of Biogeography*, 281-289.

Henschel, J., Mtuleni, V., Pallett, J., & Seely, M. K. (2003). The surface-dwelling arthropod fauna of Gobabeb with a description of the long-term pitfall trapping project. *Journal of the Namibia Scientific Society, 51*, 65-92.

Henschel, J. R., Grohmann, C., Siteketa, V., & Linsenmair, K. E. (2010). Monitoring tenebrionid beetle biodiversity in Namibia.

Kalshoven, L. (1981). The Pests of Crops in Indonesia. van der Laan PA (Rev. & trans.) Rotschild GHL (Asssist.) PT Ichtiar Baru–van Hoeve: Jakarta.

Koivula, M. J. (2011). Useful model organisms, indicators, or both? Ground beetles (Coleoptera, Carabidae) reflecting environmental conditions. *ZooKeys*(100), 287.

Luff, M. (1990). Spatial and temporal stability of Carabid communities in a grass/arable mosaic. *The Role of Ground Beetles*.

Rafi, M. A., Jürgen, W., Matin, M. A., Zia, A., Sultan, A., & Naz, F. (2010). Faunistics of tiger beetles (Coleoptera: Cicindelidae) from Pakistan. *Journal of Insect Science, 10*(1).

Saji, A., & Al Dhaheri, S. (2011). Ecological distribution and seasonality of darkling beetles (Coleoptera: Tenebrionidae) in the western region of Abu Dhabi, UAE. *Middle-East J. Sci. Res, 9*(6), 704-710.

Seastedt, T., & Crossley Jr, D. (1983). Nutrients in forest litter treated with naphthalene and simulated throughfall: a field microcosm study. *Soil Biol. Biochem, 15*(2), 159-165.

Simpson, E. H. (1949). Measurement of diversity. *nature*.

Stork, N. E. (1990). *The role of ground beetles in ecological and environmental studies*: Intercept.

Sultan, A., Borowiec, L., Rafi, M., Ilyas, M., Naz, F., & Shehzad, A. (2008). Tortoise beetles of Rawalpindi–Islamabad, Pakistan and their host preferences (Coleoptera: Chrysomelidae: Cassidinae). *Genus, 19*(1), 93-102.

ISSN: online 2617-2186 print 2617-2178

التنوع الحيوي والوفرة الموسمية للخنافس الأرضية في منطقة مسَّة

إيمان مسعود بالحسن، علي عبد القادر بطاو* ومنصور سالم عطية

قسم علم الحيوان، كلية العلوم، جامعة عمر المختار، البيضاء، ليبيا

تاريخ الاستلام: 9 مايو 2018 / تاريخ القبول: 6 ديسمبر 2018

Doi:https://doi.org/10.54172/mjsc.v33i4.296

المستخلص: أجريت تجارب هذا البحث بالقرب من منطقة مسَّة خلال الأعوام 2015–2016 لمعرفة التنوع الحيوي للخنافس الأرضية المتواجدة بمنطقة مسة بالجبل الاخضر و تحديد وفرتها الموسمية، وقد بينت النتائج وجود عدد من الأنواع التابعة لعائلتي Tenebrioidae و عائلة Carabidae وهي الأنواع التالية: *Pimelia* , *Zophosis punctuate* , *Blaps polychresta, interpunctata*, *Blaps nitens* , *Adesmia dilatata* , *Scaurus vicinus*, *Tentyria cyrenaica*, *Laemostenus complanatus*, *Ditomus cilpeatun* and *Akis costitubera.* وكان النوع *Zophosis punctuate* الأعلى تواجدا خلال فترة الدراسة (34%) ثم *Akis costitubera* (18%) و *Tentyria Cyrenaica* (13.32%)، كما سجلت الأنواع الأخرى ولكن بأعداد قليلة جدا منها: *Thorectes punticollis*, *Aethiessa floralis*, *Trox granulipennis*, *Brosus laevigatus.* كما أظهر التحليل الإحصائي ANOVA وكذلك T-test اختلافا معنويا واضحا ($P<0.05$) بين تواجد الأنواع وكذلك خلال الأشهر المختلفة وأظهرت تذبذبا واضحا في نشاطها. كما بينت المقاييس البيئية مثل مقياس سمسون وكذلك مقياس شانون أن الخنفساء *Zophosis punctuate* سجلت الأعلى من بين كافة الأنواع المتواجدة خلال فترة الدراسة. وأوضحت الدراسة أهمية عوامل المناخ و التي من بينها درجة الحرارة و مدى ارتباطها بنشاط الخنافس في منطقة الدراسة و خاصة الأنواع *Akis costitubera, Blaps polychresta and Ditomus cilpeatun.* واستخلصت الدراسة الي تأثير العوامل البيئة وكذلك اهمية استخدام المقاييس البيئة في دراسة تواجد ووفرة الخنافس.

الكلمات المفتاحية: الخنافس الأرضية، التنوع الحيوي، الوفرة الموسمية.

*علي بطاو alibataw1957@gmail.com قسم علم الحيوان، كلية العلوم، جامعة عمر المختار، البيضاء، ليبيا