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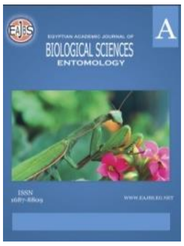

Seasonal Abundance and Population Fluctuation of Leucaena Tree Beetle, *Acanthoscelides macrophthalmus* (Schaeffer) (Coleoptera: Chrysomelidae: Bruchinae) and its Accompaniment Parasitoids

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ABSTRACT

The data presented in this study provide some basic information regarding seasonal abundance and population fluctuation, the influence of temperature and relative humidity, monthly population and emergence percentages, time and peacks number, and emergence ratios of population density of each leucaena pods and seeds beetle, *Acanthoscelides macrophthalmus* and its accompaniment parasitoids (*Dinarmus basalis* Rondani and *Lyrcus* sp.) emerged from infested *Leucaena leucocephala* trees.

Insects are abundant throughout the year. The highest monthly population of beetles recorded during November, followed by May and December, the highest population of parasitoids observed during February, followed by March and January (*D. basalis*) also January and August (*Lyrcus* sp.).Nine peaks for beetles are recoded, the higher peak observed at 4th week Nov. followed by 3rd week of May, then 4th week of January, the same number of peaks recorded for *D. basalis* parasitoid, the highest peak noticed at 3rd week of Jan. and March, whereas *Lyrcus* sp. parasitoid has 8 peaks, the higher found at 3rd week of Jan.General ratio of insect's emergence was 1:0.384:0.047 (beetles: *Dinarmus: lyrcus*). Highest ratios between beetles: parasitoids noticed during February (1:2), July (1:1.774) and March. (1:1.287). The dominant weather factors (MaxTemp., Min.Temp. & RH%.) evidently showed effective changes in the population density of beetles and parasitoids during annual activity months. The correlation between parasitoids and beetles population differed during the different seasons.

The current work shows that *Dinarmus basalis* (26.8% seasonal emergence) and *Lyrcus* sp. (3.3% seasonal emergence) parasitoids develop within infested leucaena seeds with *A. macrophthalmus* beetle. Numerous numbers of each beetle (69.9% seasonal emergence) and parasitoids (31.3% seasonal emergence) were observed throughout the year, therefore *A. macrophthalmus* beetles can be used as a substitute host for mass rearing of *D. basalis*parasitoids, which are biological agent to control stored seed bruchids.

INTRODUCTION

The adults of *Acanthoscelides macrophthalmus* (Schaeffer) beetle emerged from infested pods and seeds of *Leucaena leucocephala* trees which are spread in several regions of different Egyptian governorates. This beetle is known as an endophagous seed predator, which appears to be very effective in reducing leucaena's seed numbers, the larvae are voracious feeders and feed entirely within seeds. This insect is multivoltine and completes many generations in a year.

A. macrophthalmus beetle was found to be the only bruchid that developed in *L. leucocephala*, an introduced plant in Togo (Sue and Kobie, 2004), Glitho (1990) in Togo did not record *A. macrophthalmus* as a bruchid that develops in cultivated leguminous plants. Elder (2002) listed *A. macrophthalmus* as bruchid that attacked several wild leguminous plant species all belonging to Leucaena genera.

Several investigators were carried out various studies on the survey, biology, population dynamics and biological control of the bruchids for cowpea, leucaena tree seeds and their natural enemies, important researchers in the previous studies were Amevoin (1998) & (2005); Amevoin*et al.*, (2007); Ouedraogo *et al.*, (1996); Sanon*etal.*, (1998); Mondedji *et al.*, (2002); Sanon*et al.*, (2005); Bolévane-Ouantinam (2004); Bolévane-Ouantinam*et al.*, (2006), Shoba and Olcker (2010).

In Egypt, two species of parasitoids, *Dinarmus basalis* Rondani and *Lyrcus* sp (Hymenoptera: pteromalidae) emerged from infested leucaena seeds with *A. macrophthalmus* (Batt, M.A & A.M.Batt, 2016), the same authors carried out some morphological and biological studies on leucaena tree beetle, also the authors found that the number of beetle emergence holes on pods ranged 1-16 holes, while the most infested seeds contain only one emergence hole for the beetle, but rarely two emergence holes of beetles.

Previous studies on storage pests showed that *D. basalis* adults emerge from stored seeds (e.g., cowpea) infested with bruchid species. Most cowpea damage is due to *Callosobruchus maculatus* (Ouedraogo et al. 1996 and Amevoin*et al.*, 2005). Four species of genus Acanthoscelides (*A. centromuculatus* All, *A. mimosae* F., *A. obsoletus* Say and *A. macrophthalmus* (schaeffer) were recorded in Egypt by El-Zoheiry and Mohamed (1949), Alfeiri (1976) and Batt, M. A. & A.M.Batt 2016. Larval parasitoid*D. basalis* is parasitized on bruchid species that infest stored seeds, such as, *Callosobruchus maculatus* that infest cowpea in field and storage containers. *A. macrophthalmus* beetles were suitable for the development of *D. basalis*parasitoid (Bolévane *et al.*, 2006). An alternative to chemical methods is the use of abiological agent to control the beetle population and consequently their damage to stored seeds (Amevoin *et al.*, 2007).

The aim of this study is to get up certain basic information on seasonal abundance, population fluctuation, emergence percentages, time and emergence peaks and the effect of temperature and relative humidity on each of *A. macrophthalmus* beetle and its accompaniment parasitoids.

MATERIALS AND METHODS

Population dynamics of each *L. leucocephala* beetle (pods and seeds borer) and its accompaniment parasitoids were followed on leucaena trees planted in Dokki region, Giza governorate.

Hundred ripe pods were monthly randomly collected from 5 infested leucaena trees with *A. macrophthalmus* beetle, beginning from late December 2019 to late December 2020: seeds inside collected pods were extracted by dehiscence, these seeds put in petri dishes and continuously observed in the laboratory.

The emerged insects (beetles and parasitoids) were collected and weekly numbers of each were recorded throughout the study period. Emergence ratios between the population of the beetles and parasitoids were calculated during the different months of

2020 year.

The effect of temperature and relative humidity on the emergence of beetles and accompaniment parasitoids from infested seeds was studied during the different seasons, in addition to the correlation between the parasitoids and beetles population. The obtained data were analyzed using SAS program (2001).

RESULTS AND DISCUSSION

Emergence activities and population densities of each *A. macrophthalmus* beetle and its accompaniment parasitoids are clarified through the results of the study for the following points.

Seasonal Abundance and Population Fluctuation of Pods and Seeds Beetle of *L. leucocephala* Tree and Accompaniment Parasitoids:

1. *Acanthosclides macrophthalmus* Beetle:

Data on weekly numbers of *A. macrophthalmus* beetle and accompaniment parasitoids emerging during different months of 2020 year are represented in Fig (1).
Population fluctuation of *A. macrophthalmus* beetle indicated that the beetles are abundant throughout the year, the emergence of beetles occurred during the different weeks where apparently showed that the minimum emergence of beetles recorded during the 4th week of April (8 beetles), 2nd and 3rd week of July (11 & 8 beetles), 2nd and 3rd week of September (7 & 9 beetles), 4th week of October (9 beetles) and 1st week of November (5 beetles). The highest number of emerged beetles was 205beetles recorded during the 4th week of November, followed by 150,141beetles recorded at the 3rd and 4th week of May then 124 beetles observed during the 1st week of December.

2. Accompaniment Parasitoids:

Two species of parasitoids emerged from leucaena seeds infested by A. *macrophthalmus* beetle, the 1st is *Dinarmus basalis* Rond and the other is *Lyrcus* sp. (Hymenoptera: Pteromalidae).

2.1. *Dinarmus basalis:*

As shown in Fig (1), the weekly numbers of *D. basalis* parasitoid emerging from infested leucaena seeds with *A. macrophthalmus* beetles fluctuated during the study period. The emergence population of parasitoids detected that *D. basalis* was abundant throughout the year except for the 1st week of September, the1st week of October, the weeks 1-3 of November and the weeks 2-4 of December which no record of any emergence of *D. basalis* parasitoids.

2.2. *Lyrcus* sp.:

Weekly numbers obtained of these parasitoids from infested leucaena seeds detected that the population of *Lyrcus* sp. parasitoid was the least abundant from the previous parasitoid. No emergence of the parasitoid was observed during the weeks 1, 2, 4 of Mars; 1-4 of April; 1, 2, 4 of May; 1-4 of June; 3 of July; 1, 2 of September and 1st week of December, Figure (1).

Monthly Population and Emergence Percentages of Each *A. macrophthalmus* Beetle and Accompaniment Parasitoids:

Data illustrated in Table (1) show the monthly population and percentages of each *A. macrophthalmus* beetle, *Dinarmus basails* and *Lyrcus* sp. parasitoids emerging from infested leucaena seeds. The obtained values detected the following results:

1. *A. macrophthalmus* Beetle:

The highest monthly population of *A. macrophalmus* beetles was 381 beetle recorded during November where emergence percentage reached 17.16% from the seasonal population, followed by 16.88% emergence during May (375 beetles) then

14.36% emergence during December (319 beetles), while the minimum monthly population appeared during September (47 beetles represent 2.12% emergence) and July (62 beetles of 2.79% emergence). The emergence during different seasons indicated that the highest population of emergence beetles was 806 beetles (36.29% emergence) recorded during Autumn months followed by spring (689 beetle of 31.02% emergence), then the winter (443 beetles of 19.95% emergence), while the minimum emergence observed during the summer where the population recorded 283 beetles (about 12.74% emergence from the seasonal population), Table (1).

2.*Dinarmus basalis* Parasitoid:

On the opposite of population emergence of leacaena seed beetle, the population of *D. basalis* parasitoids emerging from infested seeds recorded the minimum percentage of seasonal emerging (2.23% emergence) for emerged parasitoids during the Autumn season (19 parasitoids), while the highest population of *D. basalis* parasitoids was 486 parasitoids representing 57.04% from seasonal emergence recorded during the winter season which followed by spring season (188 parasitoids of 23.07% emergence) and the summer season (159 parasitoids of 18.66% emergence). The highest monthly population of *D. basalis* parasitoid was 183 parasitoids recorded during February (at 21.48% emergence from seasonal population), while the lowest monthly population was 1 parasitoid recorded during December (0.12% emergence of seasonal population), Table (1).

Table 1: Monthly population and percentages of each *A. macrophthalmus* beetle, *D. basalis* and *Lyrcus* sp. parasitoid emerged from infested pods and seeds of leucaena trees during different months of 2020 year.

Season	Months	beetles		parasitoids					
		A. macrophthalmus		*D. basalis*		*Lyrcus* sp		*D. basalis* + *Lyrcus* sp	
		Pop.	Em. %	Pop.	Em. %	Pop.	Em. %	Pop.	Em. %
Winter	Jan.	215	9.68	138	16.20	36	34.29	174	18.18
	Feb.	99	4.46	183	21.48	15	14.29	198	20.69
	Mar.	129	5.81	165	19.36	1	0.95	166	17.35
	Total	443	19.95	486	57.04	52	49.53	538	56.22
Spring	Apr.	111	5.00	67	7.86	0	0	67	7.00
	May	375	16.88	93	10.92	1	0.95	94	9.82
	Jun.	203	9.14	28	3.29	0	0	28	2.93
	Total	689	31.02	188	22.07	1	0.95	189	19.75
Summer	Jul.	62	2.79	102	11.97	8	7.62	110	11.49
	Aug	174	%7.83	43	5.05	17	16.19	60	6.27
	Sep.	47	2.12	14	1.64	5	4.76	19	1.99
	Total	283	12.74	159	18.66	30	28.57	189	19.75
Autumn	Oct.	106	4.77	12	1.41	4	3.81	16	1.67
	Nov.	381	17.16	6	0.70	7	6.66	13	1.36
	Dec.	319	14.36	1	0.12	11	10.48	12	1.25
	Total	806	36.29	19	2.23	22	20.95	41	428
Grand total		2221	100	852	100	105	100	957	100

Pop. = Population Em. % = percentage of emergence

3.*Lyrcus* sp. Parasitoid:

The monthly population of *Lyrcus* sp. parasitoids emerging from infested leucaena seeds, showed that the highest population was 36 parasitoids recording 34.29% from seasonal population during January, followed by 17 parasitoids (16.19% seasonal emergence) during August, then 15 parasitoids (14.29% seasonal emergence). The lowest population was 1 parasitoid (0.95% seasonal population) observed during both March and May. No emergence of *Lyrcus* sp. parasitoid showed during both April and June. On the other hand, the winter season appeared the highest population of emergence (52 parasitoids of 49.53% seasonal emergence) followed by the summer season (30 parasitoids of 28.57% emergence) then the autumn season (22 parasitoids of 20.95% seasonal emergence, while the lowest emergence was only 1 parasitoid of about 0.95% emergence observed during the spring season.

The total population of *D. basalis* on *L.* sp. detected that the monthly population of these parasitoids was the highest during winter season (538 parasitoids of 56.22% seasonal emergence, followed by spring and summer when the population recorded 189 parasitoids representing 19.75% seasonal emergence of each, while the lowest population was 41 parasitoids (4.28% seasonal emergence) recorded during the autumn season, Table (1).

Influence of the Dominant Weather Factors (Temperature and Relative Humidity) On Population of *L. leucocephala* Tree Beetle and Its Parasitoids:

The weekly averages of each max. temp., min. temp., and RH. % affecting population abundance and fluctuation of *A. macrophthalmus* beetle, *D. basalis*parasitoid and *Lyrcus* sp. parasitoidis clarified in Fig (1) with corresponding values of emerged insects' population.

Influence of temperature and relative humidity on the population density of *A. macrophthalmus* beetle and its accompaniment parasitoids was determined by the correlation between recorded values of dominant weather factors (Max.Temp., Min.Temp. and RH. %) and the number of emerged insects (beetles and paraitoids) during different activity seasons from infested seeds of leucaena trees cultivated at Dokki, Giza governorate during 2020 year, (Table 2). The obtained data on the effect of different weather factors obviously detected the following results.

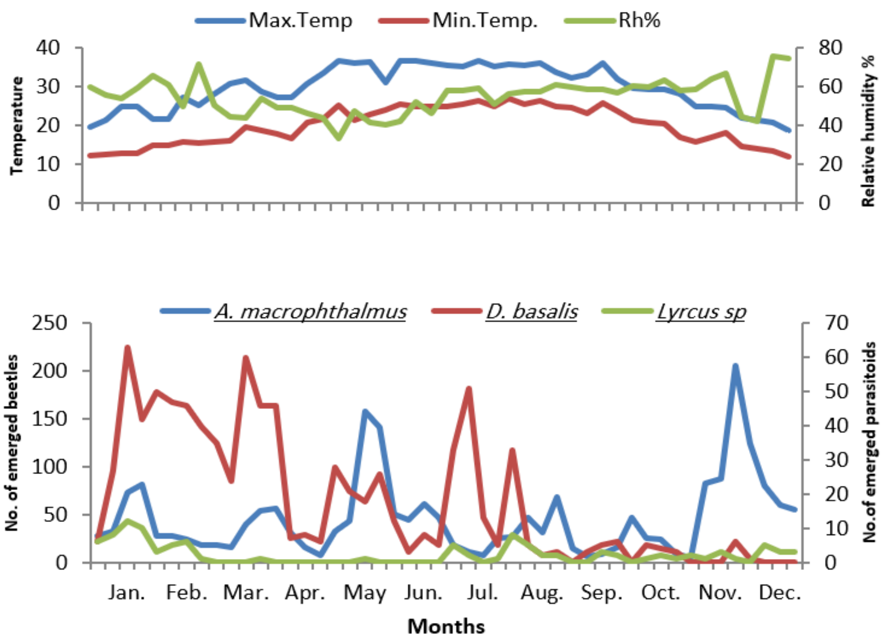

Fig. 1: Weekly number of each *A. macrophthalmus* beetle, *D.basalis* and *Lyrcus* sp. parasitoid emerging from infested seeds of L.*leucocephala* trees, with the corresponding values of temperature and relative humidity, at Giza governorate during 2020 year.

1. Influence of Weather Factors on *A. macrophthalmus* Beetles Population:

The direct effect of three weather factors on the population density of the beetles emerging during the different seasons differed according to the effective factors and the time of year (annual seasons) Table (2).

1.1. Influence of Maximum Temperature:

Effect of maximum temperature on the number of emerged beetles during the different seasons demonstrated a highly negative significant correlation between monthly averages of temperature degrees and beetles population during the winter season (r=-0.993), also negative significant correlation was observed during the autumn season (r=-0.712), while a positive correlation was noticed in the other seasons, high during the spring (r= 0.665) and moderate during the summer season(r=0.53).

1.2. Influence of Minimum Temperature:

The obtained results to the effect of minimum temperature on beetles emergence estimated by correlation coefficients indicated that the highest effect of minimum temperature noticed during the summer season (r = 0.895), while negative significant correlation appeared during the autumn season (r =-0.794), also the effect on the beetles' population was moderate and positive during the spring season (r =0.535), while it was negative during the winter (r =-0.525).

1.3. Influence of Relative Humidity:

The effect of relative humidity on the population density of Leucaena tree beetle differed during different seasons, Table (2). Highly significant negative correlation recorded during the spring season (r=-0.814), while moderate effect obtained during summer season(r=-0.508), the correlation was insignificant during both winter(r=0.106) and autumn (r= 0.348) seasons.

2. Influence of Weather Factors On Population Of Accompaniment Parasitoid Species:

Effect of different weather factors on the population of both *D. basalis* parasitoid and *Lyrcus* sp., parasitoid (Table 2) showed the following results:

2.1. On *Dinarmus basalis*Parasitoid:

2.1.1. Influence of Maximum Temperature:

Effect of Max.Temp., on the population of this parasitoids during the different seasons detected highly significant correlation during the autumn season (r =0.996), the correlation was highly significant during the summer season (r =0.799), while during the winter the correlation was the moderate effect (r =0.610), whereas insignificant effect observed during the spring season, (r =0.258).

2.1.2. Influence of Minimum Temperature:

The correlation between Min.Temp., and parasitoids during the different seasons were non-significant except through the autumn season, where the effect was moderate (r =0.573)

2.1.3. Influence of Relative Humidity:

Population density of *D. basalis* parasitoid during different seasons detected a highly negative significant correlation with relative humidity during each of spring (r=-0.933), summer (r=-0.999) and autumn (r=-0.889), while the correlation was insignificant during winter season (r=0.235).

2.2. On *Lyrcus* sp. Parasitoid:

2.2.1. Influence of Maximum Temperature:

Highly significant negative correlation between Max.Temp., and population density of *Lyrcus* sp. parasitoids emerging during two seasons of winter (r =0.993) and Autumn (r =0.999), while the temperature effect appeared moderate significant correlation during the summer season (r =0.639), the correlation was insignificant during the spring season (r=0.369).

2.2.2. Influence of Minimum Temperature:

A highly significant correlation was noticed during the different seasons, except the spring season which showed insignificant correlation (r =0.212). The correlation was negative during the winter (r = -0.937) and autumn (r = 0.986), while it was positive during the summer season (r =0.946).

2.2.3. Influence of Relative Humidity:

Different effect of relative humidity on population density *Lyrcus*sp. parasitoid during different seasons, Table (2). Highly significant correlation, negative(r=-0.964) during spring season, while it was positive (r= 0.943) during autumn season, the correlation was moderate (r= 0.545) during winter season, while it was insignificant (r=0.388) during spring season, Table (2).

The Relationship Between Population of *A. macrophthalmus* Beetle and Accompaniment Parasitoids:

The obtained results on the population of emerged insects (beetles and parasitoids) from infested leucaena seeds detected the influence of parasitoids on the beetle population through the correlation between numbers of parasitoids and beetles during the different seasons of 2020 year.

A highly significant negative correlation was recorded during the autumn season (r =-0.896), while the efficacy was moderate during the spring season (r = 0.558), followed by negative correlation during the winter season (r =-0.461), whereas insignificant correlation was noticed during the summer season (r = 0.051).

Table2: Simple correlation and regression coefficient values between each Max.Temp., Min.Temp and RH% with the number of emerged insects (beetles and parasitoids) from infested Leucaena seeds during the different season of 2020 year.

Season	Correlation (r) and Regression (b)	*A. macrophthalmus*			*D. basalis*			*Lyrcus sp.*		
		Max. Temp.	Min. Temp.	RH%	Max. Temp.	Min. Temp.	RH%	Max. Temp.	Min. Temp.	RH%
Winter	r	-0.993	-0.525	0.106	0.610	-0.354	0.235	-0.993	-0.937	0.548
	b	-2.021	-4.385	3.502	0.785	-1.442	0.763	-0.949	-2.288	1.385
Spring	r	0.665	-0.535	-0.814	-0.258	-0.412	-0.933	0.369	0.212	-0.964
	b	6.298	5.602	-23.42	-0.596	-1.054	-6.549	0.015	9.575	-0.119
Summer	r	0.530	0.895	-0. 508	0.799	0.378	-0.999	0.639	0.946	0.388
	b	7.888	25.84	23.214	7.68	7.175	-21.13	0.855	2.460	1.596
Autumn	r	-0.712	-0.794	0.398	0.996	0.573	-0.889	-0.999	-0.986	0.943
	b	-5.473	-7.019	6.379	0.292	0.105	-0.545	-0.187	-0.212	0.368

Time and Emergence Peaks Number of Each *A. macrophthalmus, D. basalis* and *Lyrcus* sp. Insects Emerging from Infested Seeds of Leucaena Trees During the Different Seasons of 2020 Year:

Data illustrated in Table (3) show the time and number of emergence peaks of leucaena seeds beetle and accompaniment parasitoids emerging during the different seasons of 2020 year. The obtained results are detected in the following points:

1. *A. macrophthalmus*Beetle:

Nine peaks of emerged beetles were recorded during the seasonal emergence population. These peaks were distributed as follows, 2 peaks for the winter season at the 4th week of Jan. (81 beetles) and the4th week of Mar. (54 beetles); 3 peaks during spring season at the 1st week of Apr. (56 beetles), 3rd week of May (158 beetles) and 3rd week of

June (61 beetles); 2 peaks for summer season at the 2nd week and 4th week of August (47 and 69 beetles, respectively), while last 2 peaks found during Autumn season observed at the 1st week of October (47 beetles) and the 4th week of November (205 beetles) (highest emergence peak), Table (3).

2. *D. basalis* Parasitoid:

Nine emergence peaks were also recorded for *D. basails* parasitoids emerging from infested leucaena seeds with *A. macrophthalmus* beetles. Three emergence peaks occurred during winter season, these peaks were observed at the 3rd week of Jan. (63 parasitoids), 1st week of Feb. (50 parasitoids) and 3rd week of Mar. (60 parasitoids). Two emergence peaks occurred during each of the spring, summer and autumn seasons. The spring peaks recorded at 1st week of April (46 parasitoids) and 1st week of May (28 parasitoids), while the summer peaks noticed at the 2nd week of July (51 parasitoids) and the 1st week of Aug. (33 parasitoids), whereas Autumn peaks recorded the minimum population, these peaks observed at 2nd week of Oct. (5 parasitoids) and 4th week of Nov. (6 parasitoids), Table (3).

3. *Lyrcus* sp. Parasitoid:

Eight emergence peaks occurred of this parasitoid during the different seasons of 2020 year. The winter population showed 2 emergence peaks recorded at the 3rd week of Jan. (12 parasitoids) and the 3rd week of Feb. (6 parasitoids), while only one peak was noticed during spring season at the 3rd week of May (1 parasitoids). During the summer season the population of parasitoids appeared 3 emergence peaks observed in the 1st week of Jul. (5 parasitoids), the 1st week of Aug. (8 parasitoids) and the 3rd week of Sept. (3 parasitoids), while two emergence peaks occurred during Autumn season at the 3rd week of Nov. (1 parasitoid) and the 2nd week of Dec. (5 parasitoids), Table (3).

Table 3: Time and emergence peaks number of each *A. macrophthalmus*, *D. basalis* and *Lyrcus* sp. insects emerged from infested pods and seeds of leucaena trees during different seasons of 2020 year.

Season	Emergence peaks of insects											
	A. macrophthalmus				*D. basalis*				*Lyrcus* sp.			
	Em.	No.	Pop.	Time	Em.	No.	Pop.	Time	Em.	No.	Pop.	Time
Winter	443	1	81	4th week of Jan.	486	1	63	3rd week of Jan.	52	1	12	3rd week of Jan.
		2	54	4th week of Mar.		2	50	1st week of Feb.		2	6	3rd week of Feb.
		-	-	-		3	60	3rd week of Mar.		-	-	-
Spring	689	1	56	1st week of Apr.	188	1	46	1st week of Apr.	1	1	1	3rd week of May
		2	158	3rd week of May		2	28	1st week of May		-	-	-
		3	61	3rd week of Jun.		-	-	-		-	-	-
Summer	283	1	47	2th week of Aug.	159	1	51	2nd week of Jul.	30	1	5	1st week of Jul.
		2	69	4nd week of Aug.		2	33	1st week of Aug.		2	8	1st week of Aug.
		-	-			-	-	-		3	3	3rd week of Sep.
Autumn	806	1	47	1st week of Oct.	19	1	5	2nd week of Oct.	22	1	3	3rd week of Nov.
		2	205	4th week of Nov.		2	6	4th week of Nov.		2	5	2nd week of Dec.
Total	2221	9	-	-	852	9	-	-	105	8	-	-

Em. = Emergence Pop. = Population

Emergence Ratios Between Population Density of Each Leucaena Beetle and Its Accompaniment Parasitoids During the Different Months Of 2020 Year:

Data illustrated in Table (4) detected the proportional emergence between population of *A. macrophthalmus* beetles and each *D. basalis* and *Lyrcus* sp. parasitoids emerging from infested leucaena seeds during different months of 2020 year. Obtained data showed that the highest ratio of emergence insects for *A. macrophthalmus* beetle: *D. basalis*: *Lyrcus* sp was 1: 1.84: 0.152 recorded during February, followed 1: 1.645: 0.129 recorded during July then 1: 1.279: 0.008 during March, while the lowest ratios observed during December (1: 0.003: 0.034) and November (1: 0.016: 0.018).

The general ratio which was estimated during a whole year of emergence recorded 1: 0.384: 0.047, while the highest emergence ratios between the total number of beetles and parasitoids (*D. basalis* and *Lyrcus*sp) were recorded during Feb. (1: 2), Jul. (1: 1.774) and Mar. (1: 1.287), whereas the total population of emerged insects from infested seeds reached 3178 adults (Table,1) recording 2221 beetles (69.9% emergence) and 957 parasitoids (30.1% emergence) distributed as 852 *D. basalis* parasitoid (26.8% emergence) and 105 *Lyrcus* sp., parasitoid (3.3% emergence).

Table 4: Emergence ratio between population density of beetles and accompaniment parasitoids from infested leucaena seeds with boring beetle *A. macrophthalmus* during the different months of 2020year**.**

Months	Emergence ratio between			
	beetles	parasitoids		
	A. macrophthalmus	*D. basalis*	*Lyrcus sp.*	*D. basalis + Lyrcus sp*
Jan.	1	0.642	0.167	0.809
Feb.	1	1.848	0.152	2.000
Mar.	1	1.279	0.008	1.287
Apr.	1	0.604	0.000	0.604
May	1	0.248	0.003	0.251
Jun.	1	0.138	0.00	0.138
Jul.	1	1.645	0.129	1.774
Aug.	1	0.247	0.048	0.345
Sep.	1	0.298	0.106	0.404
Oct.	1	0.113	0.038	0.151
Nov.	1	0.016	0.018	0.034
Dec.	1	0.003	0.034	0.037
Annual ratio	1	0.384	0.047	0.431

Important Observations:

- The observation and follow-up of the phenology of *L. leucocephala* trees showed that flowering and fructification of *L. leucocephala* trees occurred throughout the year. Consequently, the pods are abundant during the different seasons of the year. The pods differed in the length and width and numbers of seeds, the pods were about 7-25 cm (Av. 16.7 ±3.85) cm length, 8-28 mm (Av. 20.8 ± 13.1 mm) width and containing 11-28 seeds (Av. 20.2 ± 5.54) seeds.
- The pods remain on the tree for a long time, where the new green pods, unripe, ripe and indehiscent pods, ancient and dried pods are found on the tree at the same time therefore the infestation by *A. macrophthalmus* beetles continued and renewal in infested trees.
- Percentages of infestation for collected pods from infested trees ranged between 20% to 30% with av. 53.8% infestation, while the percentage of emergence holes from these pods was 68.6% for beetles and 31.4% for parasitoids.
- Experiments showed that leucaena seeds were used for oviposition of *A. macrophthalmus* beetles in the laboratory (Batt, M.A. & A.M.Batt, 2016), therefore can be used in the mass rearing of this bruchid, consequently are potential substitution host for the rearing of *D. basalis* parasitoids.

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ARABIC SUMMARY

الوفرة الموسمية وتقلبات تعداد خنفساء قرون وبذور الليوسينا *Acanthoscelides macrophthalmus* والطفيليات المصاحبة لها

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تعتبر أشجار الليوسينا (*Leucaena leucocephala*) من الأشجار الهامة اقتصادياً وذلك للفوائد المتنوعة لأجزائها المختلفة.وتهاجم قرون وبذور هذه الأشجار بواسطة الخنفساء *A. macrophthalmus* (Coleoptera: Chrysomelidae: Bruchinae) حيث تحفر اليرقات داخل البذور متغذية على محتوياتها وتسبب تدميرها.. ومع ذلك فإن الطفيليات المصاحبة لهذه الخنافس تتطفل على خنافس الحبوب المخزونة.. وتعتبر بذلك عامل حيوي في مكافحة هذه الخنافس.

ويهدف البحث الحالي إلى دراسة الوفرة الموسمية وتقلبات تعداد خنافس قرون وبذور أشجار الليوسينا والطفيليات المصاحبة لها وتأثير الحرارة والرطوبة النسبية على تعداد الحشرات وكذلك دراسة النسب المئوية الشهرية لخروج التعداد وعدد القمم ومواعيدها لكل من الخنافس والطفيليات.

وجد أن الخنافس تكون متوفرة طوال العام وسجل أعلى تعداد للخنافس خلال نوفمبر يليها مايو وديسمبر وكان أعلى تعداد للطفيليات خلال مارس ويناير للطفيل *D. basalis* ويناير وأغسطس للطفيل *Lyrcus* sp.

وقد سجلت 9 قمم لتعداد خروج الخنافس لوحظ أعلاها خلال الأسبوع الرابع من نوفمبر وسجل نفس عدد القمم لتعداد خروج الطفيل *D. basalis* والذي سجل أعلاها خلال الأسبوع الثالث لكل من يناير ومارس بينما الطفيل *Lyrcus sp.* كان له ثمان قمم من تعداد الخروج أعلاها خلال الأسبوع الثالث من يناير.

وقد كانت نسب الخروج بين الحشرات الخارجة من البذور المصابة 1: 0.384: 0.047 {خنافس: طفيل (1): طفيل (2)} بينما وجد أن أعلى النسب بين الخنافس: الطفيليات كان 1: 2 خلال فبراير، 1: 1.774 خلال يوليو، 1: 1.287 خلال مارس.

ويظهر العمل الحالي أن الطفيل *D. basalis* سجل 26.8% خروج سنوي في حين سجل الطفيل *Lyrcus* sp. 3.3% خروج سنوي بينما سجلت الخنافس 69.9% خروج سنوي ويشير البحث إلى وجود وفرة سنوية للخنافس والطفيليات يمكن من خلالها استعمال خنافس أشجار الليوسينا في التربية الكمية لطفيل *D. basalis* كعامل حيوي لمقاومة خنافس الحبوب المخزونة.

وقد سجلت بعض الملاحظات الهامة فيما يختص بالارتباط بين الفينولوجي لشجرة الليوسينا والإصابة بالخنافس والطفيليات ووفرتها.