

**LEUCAENA TREE BEETLE, *ACANTHOSCELIDES MACROPHTHALMUS* (SCHAEFFER), (COLEOPTERA: BRUCHIDAE), A NEW RECORD SPECIES IN EGYPT**

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**ABSTRACT:** *Leucaena* beetle, *Acanthoscelides macrophthalmus* Schaeffer, (Coleoptera: Bruchidae) is a species recorded for the first time in Egypt infesting pods and seeds of *Leucaena leucocephala* (Lamarck) trees. Two species of Hymenopterous parasitoids, *Dinarmus basalis* Rond and *Lycus* sp (Pteromalidae) were emerged from infested seeds with beetles. Morphological traits and appearance for beetles are described and the figures of some stages and parasitoids are illustrated. The female beetles laid the eggs on tree seeds in the laboratory, therefore, the seeds can be used in the mass rearing of bruchids which are potential substitution host for rearing of parasitoids. The mean number of laid eggs /female was 45.6 eggs. The mean times of ovipositional period were 1.2, 7.2 and 3.1 days for preoviposition, oviposition and post-oviposition periods, respectively. The mean time of egg incubation period was 5.7 days. The mean duration of larval development was 31.6 days, while mean duration of pupa was 9.2 days. The mean period of female longevity was 12.5 days, while the male beetles lived 10.2 days. The total developmental period ranged between 42 -70 days.

**Key words:** *Acanthoscelides macrophthalmus*, *Leucaena leucocephala* tree, Coleoptera, Bruchidae

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**INTRODUCTION**

*Lucaena* trees (*Leucaena leucocephala* (Lamarck), Family Mimosaceae, are perennial trees, cultivated in several governorates of Egypt as ornamental trees. These trees may grow to heights of 7-18 m, leaves are bipinnate with 6-8 pairs of pinnae bearing 11-23 pairs of leaflets 6-18mm long. The inflorescence is cream coloured, globular shape which produces a cluster of flat pods 13-18 mm long containing 15 – 30 seeds Fig. (1).

*Lucaena* is widely used in the tropics as a valuable fodder shrub for increased animal production (Khamsekhiew *et al.*, 2001). It is an ever green forage rich in protein, minerals and B-carotene. The plant can also be grazed directly, is well accepted by livestock, particularly goats and is quite resistant to heavy frequent defoliation (Meissner, 1977). This species of trees has

been reported as a weed in more than 20 countries across all continents except Europe (only in Madeira is reported) and Antarctica. In Japan, *Leucaena leucocephala*, initially introduced as a beneficial tree in 19<sup>th</sup> century and has become weedy in tropical regions of Japan and other areas (Smith 1985, Henderson 2001). In Cyprus there are records that, *Leucaena* was introduced into the island about 25 years ago as a valuable fodder plant and that this plant species was extensively cultivated in many areas and other areas in order to be given as fodder shrub to horses (Tsindides *et al.*, 2002). In Togo (Africa), this plant was introduced in 1980 to promote its use as fodder, as firewood and for atmospheric nitrogen fixing by international forestry organizations (Sue and Kobie, 2004).

Leucaena trees have been used for soil improvement, soil conservation and erosion control in diverse agroforestry combinations and systems including alley farming, live-barriers on terrace boundaries, shelterbelts or wind breaks, simply as dispersed trees over crops. Leucaena wood used for a wide range of products including domestic and industrial fuel (including electricity generation) poles, posts, sawn timber, furniture, parquet flooring, particle board and pulp, fuel wood and charcoal.

Three species of genus *Acanthoscelides* (*A. centromaculatus* All., *A. mimosae* F. and *A. obsoletus* Say.) were recorded in Egypt by El-Zoheiry and Mohamed (1949) and Alfieri (1976). Vassiliou and Papadoulis (2007- 2008) recorded the species *Acanthoscelides macrophthalmus* (Schaeffer) for the first time in Cyprus. In Southern Togo (West Africa), Bolevane (2004) surveyed *A. macrophthalmus* on wild leguminous plants, while Raghu *et al.*, (2005) and Tuda *et al.*, (2009) found that *A. macrophthalmus* feeds on the perennial shrub, *Leucaena leucocephala* (Lamark.) de Wit (Fabales: Mimosaceae).

The present study aims to record Leucaena beetle, *Acanthoscelides macrophthalmus* Schaeffer, (Coleoptera: Bruchidae) for the first time in Egypt, as well as to conduct biological studies on this beetle and its parasitoids.

## **MATERIALS AND METHODS**

### **Morphological studies:**

Pods of *Leucaena leucocephala* trees (Fig. 1) that demonstrated the infestation signs with borers (holes of beetles) were collected from the tree planted at Giza governorate. Infested pods were collected and placed in plastic containers, some seeds from the ripe dehiscent pods or some other indehiscent were collected and placed in glass Petri dishes, both pods and seeds were examined continuously.

The emerged beetles were collected and described. The insects were identified by morphological traits according to methods described by Kingsolver (2004) and classification division at Plant Protection Research Institute, Agricultural Research Centre, Giza, Egypt. The available observation during this work was illustrated.

### **Biological studies:**

The infested and non infested pods of *L. leucocephala* were collected from cultivated trees at Giza governorate and transferred to the laboratory. Collected samples were maintained at prevailing natural conditions during experimental period.

The infested pods and seeds were placed inside plastic boxes (22x15x10cm) and daily observed until the emergence of beetles which collected daily, then sexed and served in the same day to different experiments. Along with 50 seeds of *L. leucocephala*, obtained from non infested ripe pods, one couple (male and female) of newly emerged beetles of *A. macrophthalmus* were conducted in 40 replications in different Petri-dishes. The seeds in each Petri-dish were daily observed until the females start for egg oviposition and until the death of females. The seeds with eggs of each replicate were daily isolated in Petri- dishes marked by oviposition date. Daily internal examination for seeds with eggs by opening the seeds by pulverization (shaving) the lateral margin of seed integuments. Hatching date was recorded and developmental stages were observed daily until the adult emergence (next generation). The larval instars were determined by numbers of exuviae presented inside the infested seeds Total number of laid eggs by one female, oviposition periods, adult longevity, larval duration, pupal period and number of adults were estimated and life cycle was recorded.



**Fig. (1): Leaves, flowers , and pods of *Leucaena leucocephala* tree.**

To determine the generation period, some seeds with eggs left without opening until the adult emergence and new emerged beetles laid their first eggs.

## **RESULTS AND DISCUSSION**

**Distribution:** *Leucaena tree beetle, Acanthoscelides macrophthalmus* (Schaeffer) (Bruchidae: Coleoptera) is a species recorded for the first time in Egypt (Giza, Qalyubia, Minufiya, Al Sharqia , Ismailia, South Sinai) by the authors.

### **Morphological aspects:**

**Size:** body length ranged 3.34- 3.88 mm for female and 3.07 – 3.55 mm for male ( Table 2).

**Colour:** Integument red, occasionally with diffuse piceous marginal shading on elytra. Vestiture of fine dark brown, gray and golden setae in pattern shown in Fig. (2). Head and pronotum are golden with little or no pattern ;elytra with 1st , 2nd,4th,6th and 10 th interstices golden,3rd, 5th,7th and 9th with brown, golden and white quadrate or elongate maculae. The length of the elytra is slightly longer than width of the two elytra together ; male pygidial vestiture golden, evenly distributed, that of female golden with divergent brown maculae sometimes joined dorsally to form inverted U or V Fig. (3).

**Structure:** vertex punctulate, punctures tending to coalesce into sulci on frons,

frontal carina in both sexes prominent (Fig. 4 and Fig 5); male eyes prominent , male antenna Fig. (6) strongly serrate reaching 1st abdominal segment, female antenna moderately serrate reaching middle metepisternum. Hind leg Fig. (7), pecten with one along acute denticle separated by gap from two smaller denticles, distal ventral face of femur sulcate. Male pygidium apically reflexed, female pygidium olique; disk punctulate, densely setose.

### **Biological aspects.**

#### **Egg stage :**

After copulation ,the mated female lays its eggs on pods and directly on exposed seeds of leucaena tree Fig. 8. Laboratory observation detected that the eggs were laid singly on seed, but when number of seeds was limited the number of deposited eggs on seed was multiple.

Eggs are oval in shape and shining white, but become yellowish white after hatching. The pre-oviposition period ranged 1-2 days (Mean  $1.2 \pm 0.42$  days). The female laid about 31-56 eggs with a mean  $45.6 \pm 7.42$  eggs, during oviposition period which ranged 4-11 days (with a mean  $7.2 \pm 2.15$  days), while the female live about 2-4 days (with a mean  $3.1 \pm 0.74$  days) after egg oviposition (postoviposition period)., Table (1). The survival rate of egg (hatching%) was 66%, Table (2).

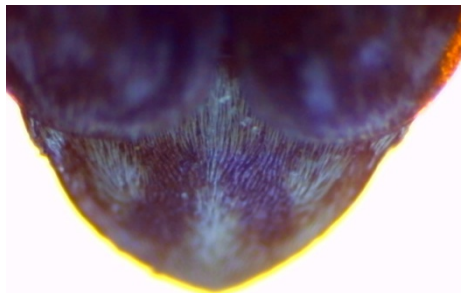


Lateral view



Dorsal view

**Fig. (2) *Acanthoscelides macrophthalmus* beetle**



**Fig. (3) Female pygidium**

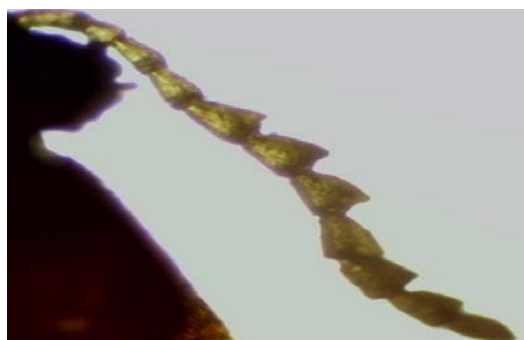


**Fig. (4) Female head**

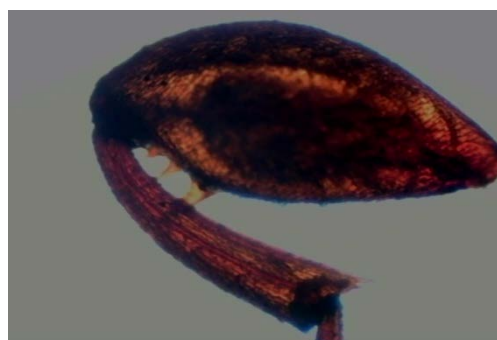


**Fig. (5) Male head**

***Leucaena tree beetle, Acanthoscelides macrophthalmus*.....**



**Fig. (6) Male antennae**



**Fig. (7) Hind leg**

**Table (1). Oviposition activities of *A. macrophthalmus* beetles under laboratory conditions (25-32C°) and ( 67-76% RH)**

Item	Number of eggs laid/ female	Periods of oviposition (in days)		
		preoviposition	oviposition	post oviposition
Range	31-56	1-2	4 -11	2-4
M. + SD	45.6 ± 7.42	1.2 ± 0.42	7.2 ± 2.15	3.1 ± 0.74

**Table (2): Duration and measurement of developmental stages of *A. macrophthalmus* beetles on seeds of *L. leucocephala* under laboratory conditions (25-32C°) - ( 67-76% RH)**

Stage	Duration (in days)		Measurements (mm)		Survival rate %	
	Range	Mean ± SD	Range	Mean ± SD		
Egg incubation Period	4-8	5.7 ± 1.34	0.25 – 0.39	0.35 ± 0.03	66	
Larva	23-36	31.6 ± 6.22	1st 0.41- 0.65 4th 2.71- 3.03	1st 0.48 ± 0.14 4th 2.87 ± 0.16	85	
Pupa	5-12	9.2 ± 2.10	2.93-3.34	3.25 ± 0.13	77	
Adult	Female	10-14	12.5 ± 0.71	3.34 – 3.88	3.65 ± 0.41	71
	Male	9-11	10.2 ± 0.79	3.07- 3.55	3.49 ± 0.24	
Total	42-70	57.9 ± 10.37	-	-	-	

**Larval stage:**

The deposited eggs on seeds hatched after 4-8 days, with a mean 5.7± 1.34 days,(egg incubation period),where the larvae feed inside the seeds. Effowe et al. (2010) recorded that the average incubation period was 4.52+ 0.85 days in the same species. The larva of first instar was white but prothoracic plate was brown, the length of 1st instar larva was about 0.48mm±0.14mm., the leg had two segments with an enlarged base. The larvae

bore into the seed, feed, grow and moult into successive instars entirely within seeds Fig. (9)., they undergo four moults before pupation. When the larva attain the fourth instar , the body length becomes about 2.71-3.03mm. (with a mean 2.87mm + 0.16mm.) and fleshy , C- shaped, widest at metathoracic and abdominal segments 1-4, tapering posteriorly. yellow but the prodorsum heavily pigmented. Leg had four clearly defined segments.



Duration of larval development ranged 23-36 days, with a mean of  $31.6 \pm 6.22$  days, the survival rate of larvae was 85% Table (2).

**Pupal stage :**

Larvae are voracious feeders and feed entirely within seeds. As larvae arrived full grown, they transform to pupae which their lengths ranged 2.93- 3.34mm, with a mean  $3.25 \pm 0.13$ mm. Fig. (10). The duration of pupa lasted about 5-12 days, with a mean  $9.2 \pm 2.1$ days then turn to Adult. , the survival rate of pupae was 77% Table (2).

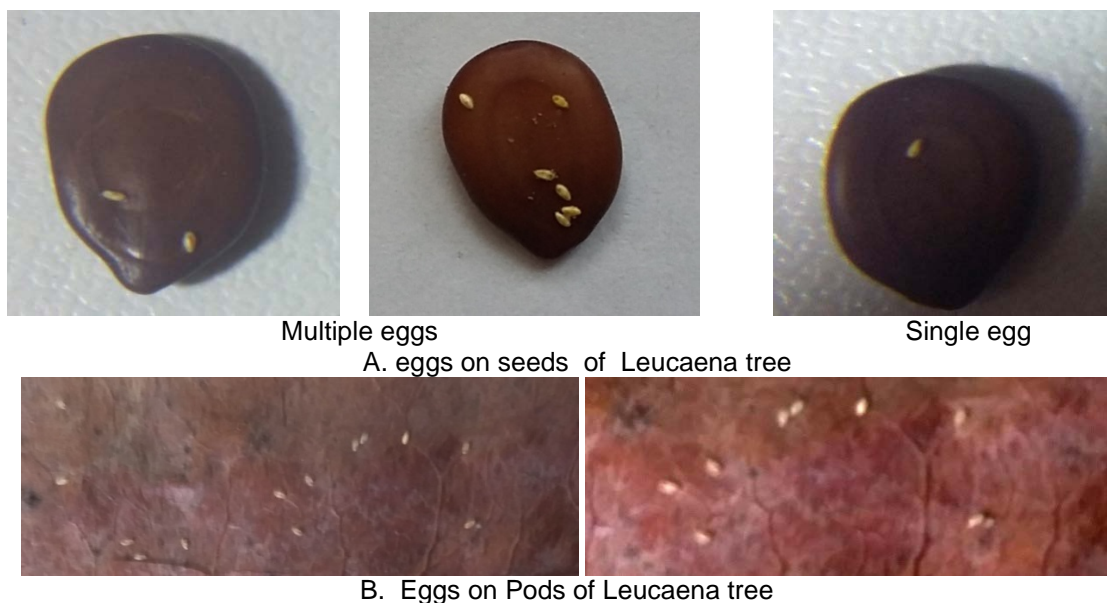
**Adult stage:**

The formed pupa inside seed undergoes metamorphosis period to adult, where it remained for some time inside the seed then it made semi-circular emergence hole in the extreme hard tegument of seed. The female emergence rate was about 53.71% (where the sexual ratio reached 1.16 :1). The

female beetles are larger in size from male beetles. The adults were strong flier and remained active most the time but frequently see feign to death.

The adult can be live up to 14 days, the female beetles lived longer than the male beetles. The female longevity ranged 10-14days, with a mean  $12.5 \pm 0.71$  days, while the male longevity ranged 9-11 days, with a mean of  $10.2 \pm 0.79$  days, Table2. Shoba and Olckers (2010) recorded that the longevity of *A. macrophthalmus* varied from 2-20 days with an average of  $11.9 \pm 3.5$  days. Gupta *et al* (2009) found that the adults live free in nature and feed on pollen and nectar.

Under laboratory condition of temperature which ranged 25-32 C° and relative humidity ranged 67- 76 % RH. The generation period ranged 42-70 days with a mean of  $57.9 \pm 10.37$ days.the survival rate of adult was 71%, Table (2).

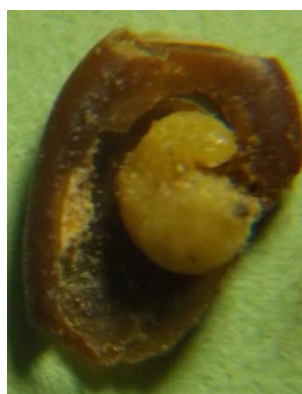


**Fig. (8): Eggs of *A. macrophthalmus* female beetle**

*Leucaena tree beetle, Acanthoscelides macrophthalmus*.....



A. Young larva



B. Full grown larva inside seed

**Fig. (9): Larva of *A. macrophthalmus* beetle**



A. Pupa

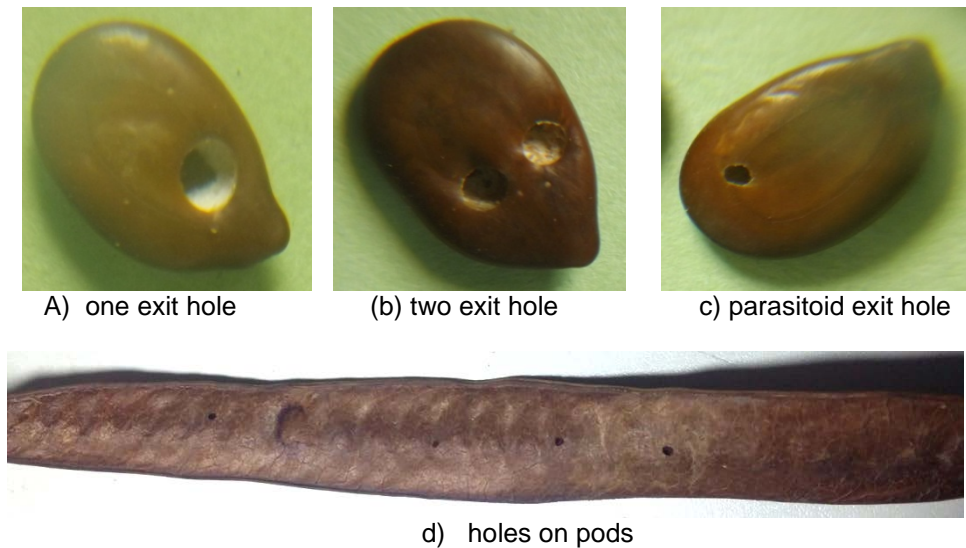


B. Pupa inside the seed

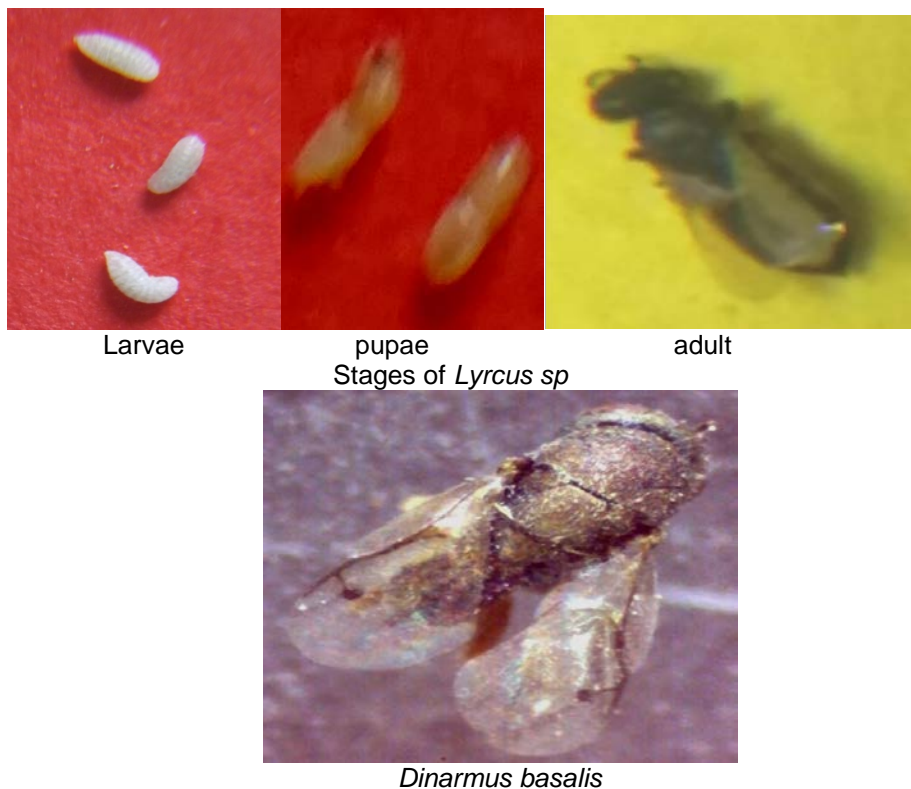
**Fig. (10): Pupa of *A. macrophthalmus* beetle**

**Important observation:**

- The examination of collected pods and seeds showed that the number of beetles emergence holes on each pod ranged between 1 - 16 holes (measure, 1.5- 2 mm.), while the most infested seeds contain only one emergency hole for beetle (1.5-1.8 mm) or parasitoid (0.3mm), but rarely two emergency holes for beetles (measures 1.2-1.4 mm) Fig. (11).
- Two species of Hymenopterous parasitoids emerged from the infested seeds, the first, *Dinarmus basalis* Rond (Pteromalidae) and the second *Lyrcus sp* (Pteromalidae)
- About 5 parasitoids inside the infested seed could be seen, Fig. (12).
- The hard tegument of seed can constitute a barrier for the penetration of the first larval instar to enter inside the seed.
- The females preferred to deposit the eggs on the new ripe pods



d) holes on pods  
**Fig. (11) Exit holes of the Beetles and parasitoids on seed and pod**



*Dinarmus basalis*  
**Fig. (12): Parasitoids of *Acanthoscelides macrophthalmus***

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## خنفساء أشجار اللبوسينا (أكانثو اسكليدس ماكروفتالمس) نوع جديد من عائلة بروكيدى ( غمدية الأجنحة) فى مصر

محمد عبد الغنى بط ، عبد الغنى محمد بط

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة - مصر

### المخلص العربى

سجل النوع أكانثواسكليدس ماكروفتالمس من عائلة بروكيدى رتبة غمدية الأجنحة لأول مرة فى مصر حيث يصيب قرون وبذور أشجار اللبوسينا ليوكوسفالالا.. وقد وجد نوعين من الطفيليات غشائية الأجنحة فصيلة بنيرومااليدى (دينارمس بازالس ، ونوع لجنس ليركس) تخرج من بذور اللبوسينا المصابة. وقد وجد أن الخنافس تضع البيض على القرون و البذور والتي يمكن أستعمالها لتربية الخنافس بهدف التربية الكمية للطفيليات، المميزات المرفولوجية ومظهر الخنافس تكون موصوفة... وأشكال بعض الأطوار والطفيليات تكون موضحة .

وقد وجد أن متوسط عدد البيض الذى تضعه الأنثى ٤٥.٦ بيضة... وقد كانت متوسطات فترة ما قبل وضع البيض ١.٢ يوم وفترة وضع البيض ٧.٢ يوم وفترة مابعد وضع البيض ٣.١ يوم وقد سجل متوسط فترة حضانة البيض ٥.٧ يوم. وقد وجد أن متوسط مدة النمو اليرقى ٣١.٦ بينما متوسط فترة العذراء ٩.٢ يوم وكان متوسط فترة حياة الأنثى ١٢.٥ يوم وفترة حياة الذكر ١٠.٢ يوم وقد تراوحت فترة النمو الكلية من ٤٢-٧٠ يوم.

### السادة المحكمون:

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