

## FIRST STUDY ON THE BIOLOGY OF LONGHORN BORER, *XYLOTRECHUS ANTILOPE* SCHÖNHERR, 1817 (COLEOPTERA: CERAMBYCIDAE) INFESTING MANGO TREES IN EGYPT

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**ABSTRACT:** Biological studies of the longhorn cerambycid borer *Xylotrechus antilope* Sch. were conducted under the laboratory conditions. The larvae attack trunks and branches of standing mango trees as well as dried branches, the larvae live and feed inside the wood causing them to be broken and die. Adult emergence occurs through an oval exit hole. Mating and egg lay usually occurs during night. Description, behavior and duration of different stages were studied. Female lay number of egg ranged between 33 – 178 eggs, hatching occurs from 9 – 14 days. Duration of larvae, pre-pupae and pupae were recorded 686 – 744 days, 10 - 14 days and 17 – 22 days, respectively. Adult longevity was affected by mating as mated males and females surviving for 7 – 18 days and 7 – 12 days, respectively, while the unmated males and females survived for 11 – 22 days and 8 – 17 days, on the contrary, the life span was not affected by starvation. Pre-oviposition, oviposition and post-oviposition periods were  $2.6 \pm 0.35$ ,  $4.1 \pm 0.47$  and  $3 \pm 0.42$  days, respectively. Generation period was 738 – 791 days with a mean of  $758 \pm 3.9$  days recording one generation per two years for *X. antilope* beetles.

**Key words:** Cerambycid borer, *Xylotrechus antilope*, biology, mango borer, beetle.

### INTRODUCTION

The cerambycid borer *Xylotrechus antilope* larvae attack trunks and branches of standing mango trees as well as dried branches, the larvae live and feed inside the wood causing them to be broken and die. *Xylotrechus antilope* was surveyed from different countries all over the world where Cherepanov and Cherepanova (1981) from USSR, listed *Xylotrechus antilope*, *X. arvicola* and *X. capricornis* among trunk borer which attack oak trees. Ashihara (1982), in Japan, stated that the grape tree borer *X. pyrrhaders* Bates has one generation per year and overwinter in its larval stage. From Hungary, Szontagh (1985) mentioned that *X. antilope* cause deterioration of the wood of sessile oak (*Quercus petraea*). From India, Butani (1993) recorded *X. smeii* on mango trees. Symptoms of infestations and type of damage were discussed. From Thailand, Visitpanich (1994) conducted investigation on the biology and survival rate of the coffee stem borer *X. quadripes*. He described the life cycle and recorded the duration of each stage from infested Arabica coffee trees

which confined in the cages. From France, Rouard (1995) listed 14 cerambycid beetles known to exist in the country among them *X. antilope* was included. Wang *et al.*, (1999), stated that the life cycle of *X. namanganensis* Heyden has one generation every two years. Guo-Zhonghua *et al.*, (2004) mentioned that *X. robusticollis* had one generation per two years. Adult emergence period ranged from first of July to first of August. OEPP - EPPO (2005), recorded *X. altaicus* on (*Larix* spp.) It attacks trees that are healthy and never attack cut, dying or dead trees, life cycle was described.

Studies concerning *X. antilope* all over the world showed lack information of the biology of this borer, while in Egypt, the previous studies on survey of wood and fruit tree borers conducted by (Willcoks, 1924; Shalaby, 1958; Nour, 1963; Alfieri, 1976; Moussa, 1977; Helal, 1986; Batt, 1989; Okil, 1991; Haggag, 1991 and Batt and Girgis, 1996) have been revealed the existence of several coleopteran species as wood and tree borers. No record of the cerambycid borer *X. antilope* was recorded

in Egypt before, except that noted by Alfieri, 1976 who mentioned that *X. antilope* was collected from some buildings in Qaluobia governorate. The cerambycid *X. antilope* was surveyed by Hashim, 2009 and recorded for the first time in Egypt as a mango tree borer. According to available literature, there is no information about *X. antilope*. The aim of the current study is to throw the light on the biology of *X. antilope* borers in Egypt for the first time on Mango trees under laboratory conditions.

## **MATERIAL AND METHODS**

Branches and trunks of mango trees infested with *Xylotrechus antilope* were collected during winter months (December, 2010 and January, 2011) from Bilbeas district, Sharkia governorate. Specimens were kept in a wire – screen cage measuring 100 x 30 x 30 cm. under laboratory conditions. Daily examination was conducted until adult emergence. Newly emerged adults were collected and identified into males and females. For studying egg laying behavior, a pair of beetles (male and female) was placed in a breeding glass lantern globe (20 cm. length and 8 cm. diameters) with open ends. One opening (narrow upper) was covered with muslin cloth secured with a rubber band, while the other was shut by resting the lantern in a Petri-dish. One cutting of non-infested mango wood (10 x 3 cm.) was placed in a glass lantern for oviposition. Ten cages (10 replicates) were used and examined daily. The deposited eggs were collected and kept in a Petri – dish under laboratory conditions until hatching. Daily inspection for hatching, incubation period and rate of hatchability were estimated. The egg laying behavior and adult longevity were noted. The newly hatched larvae were reared on branches of mango trees. Ten newly hatched larvae were placed into fresh cuttings of mango trees (30 x 5 cm.) through suitable artificial holes perforated with a sharp tool. Six months later, the surviving larvae were individually transferred to new cuttings (10 x 3 cm.) and kept in a glass jar of a suitable size. The larvae were transferred to new cuttings periodically whenever necessary.

The pre-pupa were placed in Petri – dishes for daily examination until reaching pupal and adult stages. The duration of different stages were estimated. The longevity of beetles as being affected by mating was also estimated using 10 males and 10 females. For studying the effect of feeding on adult longevity, 10 pairs of newly emerged beetles used. Each pair was placed in a glass jar containing cuttings of mango wood. Another 10 pairs were used in a similar manner but left without feeding.

## **RESULTS AND DISCUSSION**

### **1. Egg stage**

The obtained results were represented in Tables (1-4) and Figs. (1-4) revealed that , the newly deposited egg of *Xylotrechus antilope* Sch. is white in color and oval in shape, before hatching showed off-white color, the egg length ranged between 1.9 – 2.5 mm with mean average of  $2.06 \pm 0.08$  mm., while egg width ranged between 0.8 – 1.2 with mean average of  $0.88 \pm 0.03$  mm., (Table 1) and (Fig. 1).

Field and laboratory observations revealed that females lay their eggs singly in bark crevices or near injuries, incubation period ranged between 9 – 14 days with mean of  $9.8 \pm 0.4$  days under laboratory conditions of  $33.1$  °C and  $55.2$  % R. H., (Table 2).

Similar results were recorded by Wang *et al.*, (1999), who noted that the female of *X. namanganesis* lays several eggs in bark cracks, eggs incubation period was about 13- 16 days, in addition to the findings of OEPP-EPPO (2005) which recorded that egg incubation period of *X. altaicus* on (*larix* spp.) ranged from 13-16 days.

### **2. Larval stage:**

#### **2-1. General description:**

The newly hatched larvae was white in color, their length ranged between 1.8 – 2.3 mm. with mean of  $1.74 \pm 0.05$  mm. while, their width ranged from 0.8 – 1.03 mm. with mean of  $0.71 \pm 0.01$  mm, head capsule measured 0.4 – 0.8 mm. with mean of  $0.44 \pm 0.02$  (Table 1).

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**Table (1): Measurements of different stages of the longhorn beetle *Xylotrechus antilope***

Beetle Stages		Length (mm)	Width (mm)	Head capsule(width) (mm)	Antennae (mm)
Egg	Mean $\pm$ S.E.	2.06 $\pm$ 0.08	0.88 $\pm$ 0.03	-	-
	Range	1.9- 2.5	0.8 - 1.2	-	-
Larvae	Mean $\pm$ S.E.	1.74 $\pm$ 0.05	0.71 $\pm$ 0.01	0.44 $\pm$ 0.02	-
	Range	1.8 - 2.3	0.8 - 1.03	0.4 - 0.8	
	Mean $\pm$ S.E.	19.6 $\pm$ 0.6	6.7 $\pm$ 0.41	3.82 $\pm$ 0.09	-
	Range	17- 25	6 – 9	3.1 - 5	-
	Mean $\pm$ S.E.	19.1 $\pm$ 0.5	5.3 $\pm$ 0.09	-	-
	Range	16 - 25	3.8 -5.2	-	-
Pupa	Mean $\pm$ S.E.	19.6 $\pm$ 0.5	6.5 $\pm$ 0.54	-	-
	Range	17 – 25	4.8 – 9	-	-
Adult Females	Mean $\pm$ S.E.	16.3 $\pm$ 0.37	4.6 $\pm$ 0.25	-	6.1 $\pm$ 0.33
	Range	14 -- 18	4 –7	-	5 --7
Adult Males	Mean $\pm$ S.E.	15.1 $\pm$ 0.25	4.2 $\pm$ 0.25	-	5.8 $\pm$ 0.29
	Range	14-17	4-6	-	5—6



**Fig (1): Eggs of *X. antilope* Sch.**

*X. antilope* full grown larvae color is whitish to yellowish, legless, sub – cylindrical and elongate, the head is partially flattened, retracted inside the prothorax as if that of flattened - head larvae. The prothorax is the largest compared to other thoracic

segments. The body length of full grown larvae ranges between 17 – 25 mm. with mean of 19.6  $\pm$ 0.6, the width ranges 6 – 9 mm. with mean of 6.7 $\pm$ 0.41, the head capsule measured 3.1 – 5 mm. with mean of 3.82 $\pm$ 0.09, (Table 1) and (Fig. 2).

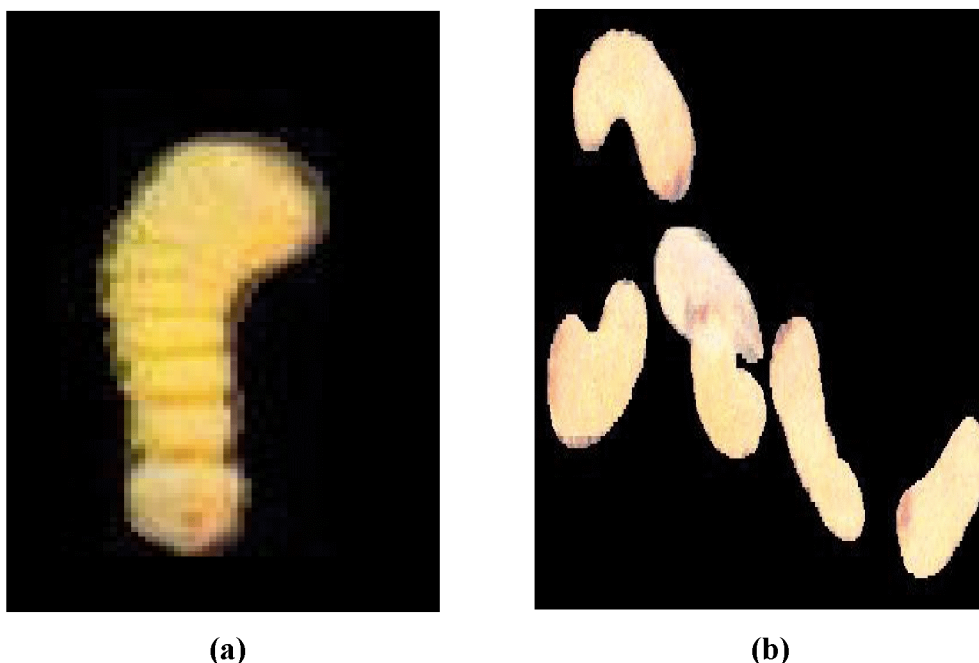


Fig (2): Full grown larvae (a) & first instars (b) of *X. antilope* Sch.

#### 2-2. Larval behavior:

Hatched larvae emerge from the egg by boring through the bottom of the shell directly into the bark causing narrow mines which increase gradually in width with the increasing of larval growth, the galleries are mostly curved and extend through sap and heart wood in all directions. Most of resultants and excreta of the borer were pressed and packed inside the galleries. The full grown larvae construct the pupal chamber at the end of larval tunnels where they transformed into inactive pre-pupa to pupate.

These findings are somewhat in agreement with those obtained by Visitpanich (1994) for the coffee stem borer *X. quadripes*. He showed that the larvae tunneled into the stem in all directions, while, OEPP-EPP0 (2005), mentioned that larvae of *X. altaicus* on (*larix* spp.) make horizontal tunnels in stems and branches.

#### 2-3. Larval duration:

The duration of larval stage was studied under laboratory conditions (Temp. 28.2 °C and 58.2 % R. H.), recorded data showed a period ranged from 686 to 744 with average mean of  $708.0 \pm 4.2$  for larval duration, (Table 2).

#### 2-4. Prepupal form:

When larvae reach to the end of last larval instar stage, they started to construct their pupal chamber at the end of galleries, then stop feeding and become inactive forming what is known as prepupal form. The prepupal color is whitish, the prepupal length ranged between 16 - 25 mm. with an average  $19.1 \pm 0.5$ , while their width ranged between 3.8 - 5.2 with an average  $5.3 \pm 0.09$ , Table (1) and (Fig. 3).

Prepupal duration takes about 11 - 14 days with mean of  $12.3 \pm 0.34$  days under laboratory conditions 29.4 °C and 64.3 % R.H., (Table 2).

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**Table (2): Duration of different stages and generation period of the cerambycid borer *Xylotrechus antilope* Sch. on mango branches under laboratory conditions.**

Stage	Duration in days		Lab. Conditions	
	Range	Mean $\pm$ S.E.	Temp. $^{\circ}$ C	R. H.%
Egg	9 – 14	9.8 $\pm$ 0.4	33.1	55.2
Larva	686 – 744	708.0 $\pm$ 4.2	28.2	58.2
Pre-Pupa	11 – 14	12.3 $\pm$ 0.34	29.4	64.3
Pupa	17 – 22	19.1 $\pm$ 0.42	29.6	67.2
<u>Adult hardness</u>				
Male	6 – 8	6.8 $\pm$ 0.56	34.8	69.1
Female	5 – 10	8.3 $\pm$ 0.41	34.8	69.1
Generation period	738 – 791	758.8 $\pm$ 3.9	31.01	62.8



**Fig (3): Prepupa of *X. antilope* Sch.**

**3. Pupal stage:**

The pupal stage type of *X. antilope* borer is exarate paua, yellowish in color during the first few days (3 - 5) days, later and gradually its color turns into brownish, pupal duration takes 17 – 22 days with mean 19.1  $\pm$ 0.42 days under laboratory conditions 29.6 and 67.2 % R.H., (Table 2).

The obtained results disagree with those obtained by Visitpanich (1994), who recorded that duration of pupal stage of the cerambycid borer *X. quadripes* Chevrolat was 11 days in average. Similarly, Ashihorao (1982), mentioned that the pupal stage of the grape borer *X. pyrrhoderus* Bates ranged from 10 – 14 days, these differences may due to differences of the borer species, the host plant or laboratory conditions.

#### 4. Adult stage:

##### 4-1. General description and behavior:

The adult is a medium sized, slender beetle, body length ranged 14 – 18 mm. with mean of  $16.3 \pm 0.3$  and 14–17 mm. with mean of  $15.1 \pm 0.25$  mm. and width ranges from 4 –7 with mean of  $4.6 \pm 0.25$  and 4 – 6 mm. with mean of  $4.2 \pm 0.25$  in both males and females, respectively, antennae range between 5 –7 mm . with mean of  $6.1 \pm 0.33$  mm. and 5 – 6 mm. with mean of  $5.8 \pm 0.29$  mm. in both males and females, respectively, (Table 1).

The adult beetle of *X. antilope* is brown – black in color with grey ventral pubescence, head small and rounded, frons with sharp lateral margins and with a medial elevation; vertex coarsely punctured; antennae rather thick, barley reaching middle of elytra in male and slightly overreaching humeral swellings in female and black in color; tarsi and tibia are reddish brown in color; pronotum very valuated and with 4 small yellow tomentose spots, elytra with 3 oblique yellow tomentose stripes and with yellow humeral and scutellar spots, abdominal

sternites are yellow-margined posteriorly, (Fig. 4).

Before emergence the adult remain motionless in pupal chamber for a period ranged between 6 – 8 and 5 – 10 days with mean of  $6.8 \pm 0.56$  and  $8.3 \pm 0.41$  for both males and females, respectively, until hardness of the cuticle takes place under laboratory condition  $34.8^\circ\text{C}$  and 69.1 R.H.% (Table 2), finally, adult beetle find its way to outside through a rounded exit hole, Visitpanich (1994) recorded that the hardness period for *X. quadripes* was 5 days in average. Laboratory observations showed that males are capable of mating after 2 – 3 hours after emergence and mating period takes 1 – 2 minutes.

##### 4-2. Egg- laying behavior:

Females usually lay their eggs during day light and rarely during the night, they take time period ranging 1 – 4 days before laying eggs, the mean pre-oviposition period was  $2.6 \pm 0.35$  days. Females continued laying eggs for a period ranged from 2 – 7 days with mean average of  $4.1 \pm 0.47$  days, (Table 3).



Fig (4): Adult beetle male of *X. antilope* Sch. (Right) and adult female (Left)

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**Table (3): Egg laying behavior and adult longevities of *X. antilope* under laboratory conditions**

Female No.	Oviposition period in days			No. of laid eggs	Adult longevity	
	Pre oviposition	Oviposition	Post oviposition		Male	Female
1	2	2	3	33	7	12
2	3	5	4	178	12	15
3	4	6	1	114	11	16
4	4	7	1	169	12	18
5	2	4	3	85	9	12
6	1	3	3	34	7	9
7	3	4	5	152	12	13
8	2	3	4	70	9	11
9	3	3	3	65	9	10
10	2	4	3	73	9	11
Mean ± SE	2.6 ±0.35	4.1± 0.47	3 ± 0.42	97.3 ±16.3	9.7 ±0.51	12.7 ±1.02
Range	1 – 4	2 – 7	1 – 5	33 - 178	7 – 12	10 – 18

The total number of laid eggs by a fertilized female during its life span ranged from 33 – 178 eggs with an average 97.3 with an average  $\pm 16.3$ . The post-oviposition period lasted 1 – 5 days with an average  $3 \pm 0.42$ , (Table 3). Obtained data disagree with OEPP-EPPO (2005), who stated that egg stage last 13-16 days for *X. altaicus* on (*larix* spp.), oviposition period was two weeks and The female lay more number of eggs in the period 5-6 days. Different species and host plant as well as laboratory conditions may be limiting factors for such differences.

**4-3. Adult longevity:**

As shown in Table (3), the obtained data showed that the longevity of adult females of *X. antilope* Sch. ranged from 7 -12 days with a mean of  $9.7 \pm 0.51$  days, whereas, the male longevity ranged from 10 – 18 days with a mean of  $12.7 \pm 1.02$  days. The whole Generation period for *X. antilope* ranged between 738 – 791 days with a mean of

$758 \pm 3.9$  days recording one generation lasted for two years for this borer. Similarly, Wang *et al.*, (1999), stated that the life cycle of *X. namanganesis* Heyden has one generation every two years. Also, Guo-Zhonghua *et al.*, (2004) mentioned that *X. robusticollis* had one generation per two years.

**4-4. Effect of mating and feeding on adult longevity:**

As for , longevities of mated and fed adults were compared with unmated and starved ones (Table 4). Longevities ranged between 7 - 18 days with mean of  $13.3 \pm 1.01$  in case of mated males; while, in case of unmated males' longevities ranged between 11 – 22 with mean of  $16.6 \pm 1.22$ , on the other hand, longevities of mated and unmated females recorded rang between 7 – 12 days with mean of  $9.3 \pm 0.48$  and 8 – 17 days with mean of  $12.9 \pm 0.81$ , respectively.

Table (4): Effect of mating and feeding on *X. antilope* Sch. adults.

Status	Longevity of adults in days			
	Male		Female	
	Range	Mean ± S. E.	Range	Mean ± S. E.
Mated	7 – 18	13.3 ±1.01	7 – 12	9.3 ±0.48
Unmated	11 – 22	16.6 ±1.22	8 – 17	12.9 ±0.81
Fed	8 – 20	12.9 ±1.02	9 – 14	9.5 ±0.64
Starved	7 – 19	13.1 ±0.88	8 – 13	8.7 ±0.69
"t" for mated and unmated: Males : 2.48 Females : 2.41				

Statistical analysis showed that mating has a significant effect on males and females longevities ("t" = 2. 48 and 2. 41, respectively).

Concerning to the effect of feeding and starvation, it had been found that, longevities of fed and starved males were 8 – 20 days with mean of 12.9 ±1.02 and 7 - 19 days with mean of 13.1 ±0.88, respectively. While, it was 9 – 14 days with mean of 9.5 ±0.64 and 8 – 13 days with mean 8.7 ±0.69 for fed and starved females, respectively. Statistical analysis showed no significant effect on beetle longevities Table (4).

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## أول دراسة عن بيولوجى الناخر ذو القرون الطويله والذي يصيب اشجار المانجو بمصر

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### المخلص العربى

أجريت دراسة تحت الظروف المعملية لأول مرة بمصر عن بيولوجية الناخر ذو القرون الطويلة *Xylotrechus antilope* Sch. من رتبة Coleoptera عائلة Cerambycidae والذي يصيب اشجار المانجو بمعهد بحوث وقاية النباتات بالجيزة ، حيث ان يرقات هذا الناخر تحدث اضرارا بالغة بعمل انفاق داخل سوق و افرع اشجار المانجو اثناء تغذيتها مما يؤدي لاضعاف الاشجار ومن ثم موتها، تبين من الدراسة ان عملية التزاوج ووضع البيض تحدث خلال فترات النهار غالبا، تضع الانثى متوسط من ٣٣- ١٧٨ بيضه ، تتم عملية الفقس فى غضون ٩- ١٤ يوم وتم تقدير فترات العمر اليرقى الذى تراوح ما بين ٦٨٦- ٧٤٤ يوم وقبل ان تتعدر اليرقات تدخل فى طور سكون يعرف بفترة ما قبل التعدر والتي تم تقديرها بحوالى ١٠-١٤ يوم ، اما فترة التعدر فتراوحت بين متوسط ١٧ - ٢٢ يوم . أوضحت الدراسة ان التزاوج يؤثر على فترة حياة الخنافس البالغة حيث تبين ان الذكور و الاناث التى تتزاوج تتراوح فترات حياتها ما بين متوسط ٧- ١٨ و ٧- ١٢ يوم على الترتيب، بينما الذكور و الاناث التى لم تتزاوج فقد تراوحت فترات حياتها بين متوسط ١١ - ٢٢ و ٨ - ١٧ يوم على الترتيب، وعلى الجانب الاخر لم يكن هناك تأثير للتغذية على اعمار الخنافس من الذكور أو الاناث. تراوحت فترات ما قبل وضع البيض و وضع البيض و مابعد وضع البيض ما بين ٢.٦ ± ٠.٣٥ يوم ، ٤.١ ± ٠.٤٧ يوم ، ٣.٠ ± ٠.٤٢ يوم ، على الترتيب . تراوحت طول مدة الجيل مامتوسطه ٧٣٨ - ٧٩١ يوم ، وبذلك يكون لهذا الناخر جيل واحد كل عامين على اشجار المانجو .

