

LABORATORY OBSERVATIONS ON THE METALLIC
BEETLE, *ANTHAXIA CONGREGATA* KLUG.
(COLEOPTERA : BUPRESTIDAE)

ABD EL-GHANY M. BATT

Plant Protection Research Institute, Agricultural Research Centre, Dokki, Giza.

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Abstract

Laboratory investigations indicated that the metallic beetle *Anthaxia congregata* klug. (Coleoptera: Buprestidae) has one generation per year. Population follow up revealed two distinct peaks of adult occurrence by the ends of April and May, respectively.

Pupae and adults were abundant from March till June. Significant positive correlation occurred between the number of emerged beetles and the maximum temperature, while the effect of minimum temperature was insignificant. Relative humidity showed a negative relationship with the number of emerged beetles. The effect of minimum temperature on the population of full grown larvae was significantly negative. Similarly, the effect of relative humidity on the abundance of pupae was negative and significant.

The percentages of natural larval, pupal and adult mortalities were 6.9, 1.3 and 2.6%, respectively, while the percentages of parasitism by an unidentified chalcidid parasitoid and beetles emergence were 19% and 70.2%, respectively.

Generation duration ranged 351-400 days and the period of emergence extended to 1-20 days. The number of emerged beetles differed according to host. The highest number of emerged beetles was produced from acacia cuttings (42 beetles), while the least number resulted from fig cuttings (12 beetles).

INTRODUCTION

The metallic beetle (*Anthaxia congregata* Klug. attacks many wood and fruit trees and causes serious damage to them. Records of the host range of this pest in Egypt refer that it attacks sponge tree (Willcoks, 1924; Nour, 1963; Alfeiri, 1976; Batt, 1989), *Acacia tortilis* (Alfeiri, 1976), Egyptian acacia and nabk trees (Nour, 1963; Helal, 1986; Batt, 1989), prickly broom (Nour, 1963), peach, common fig, citrus, white paplar, christmasberry and apricot trees (Batt, 1989).

Larvae of this pest bore beneath the bark of stem and branches making tunnels which are filled with tightly packed compact dust. Larval feeding injures the phloem and cambium and subsequently bark becomes loose and detached from wood. Due to

this damage, the infested trees become weak and their branches die.

The present work aims to add new knowledge on the seasonal abundance, biology, annual generations and host plants of such important pest.

MATERIALS AND METHODS

Population dynamics: Acacia cuttings infested with *A.congregata* were collected from El-Fayoum Governorate in 1996 at a rate of 30 cuttings/week. Cuttings (25cm. long by 2.5 cm. diameter) were placed in glass jars (40 cm. height by 20cm. diameter) and emerged beetles were counted.

Another group of 20 cuttings were used for the biological studies on *A.congregata*. Cuttings were splitted off and the number of immature larvae, full grown larvae, prepupae, pupae and adults existing inside them were counted. The monthly percentages of developmental stages were also calculated. The natural mortality of larvae, pupae and adults was calculated. Percentages of beetle emergence and parasitism were determined as follows:

$$\text{Natural mortality \%} = \frac{\text{No. of dead individuals (larvae, pupae and adults)}}{\text{Total number of individuals}} \times 100$$

$$\text{Emergence of beetles \%} = \frac{\text{No. of emerged beetles}}{\text{Total number of individuals}} \times 100$$

$$\text{Parasitism \%} = \frac{\text{No. of emerged parasites}}{\text{Total number of individuals}} \times 100$$

Number of annual generaions: Work started on the 4th. week of April 1996 with 30 couples of emerged beetls. Every couple was introduced into a separate glass jar provided with two non-infested acacia cuttings of the same forementioned size. Cuttings were examined daily until oviposition took place. The durations of the different stages was determined by successive peeling of the bark of the cuttings till the emergence of new beetles.

Effect of host plant: Tested host plants were acacia, willow, fig, mango, peach and pear. Two cutting of each host plant (25cm. long by 2 cm. diameter) were introduced in a glass jar (40cm. height by 20cm. diameter) and 10 pairs of newly

emerged beetles were released in the jar. Five jars (replicates) were used. When the last beetle died, the beetles were removed from the jars and cuttings were left under the prevailing laboratory conditions until the emergence of new adults from them. The number of emerged beetles, duration of emergence period and the generation duration were determined.

RESULTS AND DISCUSSION

Population Studies: *Anthaxia congregata* beetles emerged from the infested cuttings between the 4th week of March and the end of June, 1996. The numbers of emerged beetles showed two peaks, one by the 4th week of April and the other by the 4th week of May, Fig.1. Batt et al. (1993) mentioned that the activity period of *Anthaxia congregata* beetles on citrus trees occupied 14 weeks (from late March until early July).

As seen in Table 1, significant positive correlation occurred between the number of emerged beetles and the maximum temperature, while the effect of minimum temperature was insignificant. Relative humidity showed a negative relationship with the number of emerged beetles.

Table 1. Monthly percentages of the different developmental stages of *Anthaxia congregata* on acacia cuttings in 1996.

Month	Percentage of					Means of		
	Immature larvae	Full grown larvae	Prepupae	Pupae	Adults	Temp. °C.		R.H%
						Min.	Min.	
January	87	13	0	0	0	4.4	16.9	65.4
February	59	27	14	0	0	5.3	22.0	59.0
March	17	38	30	13	2	8.0	26.2	58.0
April	4	8	10	32	46	11.7	30.2	50.3
May	2	10	15	19	54	17.0	43.9	44.0
June	77	0	2	2	19	19.9	34.1	55.5
July	100	0	0	0	0	21.7	37.4	50.3
August	100	0	0	0	0	20.6	36.0	52.6
September	100	0	0	0	0	19.4	34.3	53.5
October	100	0	0	0	0	18.2	31.8	55.9
November	100	0	0	0	0	12.6	23.5	61.2
December	100	0	0	0	0	8.0	21.6	65.0

The monthly percentages of the different stages of *A.congregata* in acacia cuttings during 1996 are shown in Table 1 and graphically illustrated in Fig 2. These table and figure indicate that the lowest percentage of immature larvae (2%) occurred in May and the highest percentage (100%) in July - December. Full grown larvae existed from January (13%) till March (38%). Prepupae appeared in February (14%) and their maximum population (30%) was recorded in March. Pupae and adults were abundant from March till June. The highest percentages of pupae and adults took place in April (32%) and May (54%), respectively.

The different developmental stages were not affected by monthly mean temperature. However, the effect of minimum temperature on the population of full grown larvae was significantly negative. Similarly, the effect of relative humidity on the abundance of pupae was negative and significant.

As seen in Table 2, the percentages of natural larval, pupal and adult mortalities were 6,9%, 1,3% and 2,6%, respectively. The mean percentage of emerged beetles was 70,2%(54,9-100). The percentage of parasitism by an unidentified chalcidid parasitoid was 19% (0-27. 6).

Table 2. Percentages of natural mortality of the different developmental stages of *A.congregata*.

Stage	Natural mortality %
Larva	6.9% (0-11.2)
Pupa	1.3% (0-1.5)
Adult	2.6% (0-4.8)

Number of generations : Data on the duration of the different developmental stages of *A.congregata* beetle under laboratory conditions of 15-35°C and 45-75% R.H. are given in Table 3.

Incubation period ranged 7-17 days with an average of 12±3.16 days. Immature larvae lasted from 210 to 280 days, with an average of 245±22.19 days. Full grown larvae elapsed 22-57 days, with an average of 37.56±12.18 days. Full grown larvae entered a prepupal stage for 7-52 days, with an average of

32.3±12.13 days. The duration of the pupal stage ranged 4-29 days, with an average of 13.77±6.12 days. Beetles remained in the pupal chamber for 3-17 days (9.25± 5.58 days as an average). Adult longevity ranged between 4-28 days, with an average of 12.46±5.00 days.

Previous results refer that *A.congregata* completes one generation every year. Generation duration ranged 358 - 387 days, with an average of 369.6±8.83 days. Batt (1989) found that under laboratory conditions, the oviposition period of *A.congregata* beetles lasted for 4-14 days and egg hatched in 7-15 days, while the durations of the prepupal, pupal and adult hardness stages were 35.6, 16.8 and 8.8 days, respectively. The longest adult longevity was 15.1 days and the shortest 8.6 days.

Table 3. Durations of the different developmental stages of *Anthaxia congregata* under laboratory conditions of 15-35°C and 45-75% R.H.

Stage	Duration (in days)	Range of	
		Temp °C	R.H %
Egg	12.00 ± 3.16 (7-17)	15 - 30	50 - 60
Immature larva	245.00 ± 22.19 (210-280)	15 - 30	50 - 75
Full-grown larva	37.56 ± 12.18 (22-57)	15 - 30	45 - 75
Pre - pupa	32.30 ± 12.13 (7-52)	20 - 35	45 - 75
Pupa	13.77 ± 6.12 (4-29)	25 - 35	45 - 75
Adult:			
Hardness period	9.25 ± 5.58 (3-17)	25 - 35	45 - 75
Longevity period	12.46 ± 5.00 (4-28)	25 - 35	50 - 70
Total Generation period	396.60 ± 8.83 (358 - 387)	15 - 35	45 - 75

Effect of host plant: The effect of host plants on certain aspects of the biology of *A.congregata* is shown in Table 4. Generation duration on the different tested hosts ranged 351-400 days. The longest average duration occurred on peach (376.5 ± 16.50 days) and the shortest on pear (356.7 ± 6.65 days). The longest duration of beetles emergence took place on pear (17.3 ± 2.44 days) and the shortest duration on mango (4 ± 0.89 days).

The number of emerged beetles differed according to host. The highest number of emerged beetles was produced from acacia cuttings (42 beetles), while the least number resulted from fig cuttings (12 beetles). The differences in the number of emerged beetles on different tested hosts was highly significant, (L.S.D. = 3.23), Table 4.

Table 4. Effect of host plant on the generation duration, duration of emergence and number of emerged beetles of *Anthaxia congregata* under laboratory conditions.

Host	Generation duration (days)	Emergence duration (days)	Number of emerged beetles		
			Total number	Av. \pm S.E (Range)	Groups
Acacia	363.2 ± 9.73 (351-378)	11 ± 2.16 (9-14)	42	8.4 ± 5.54 (3-18)	
Pear	356.7 ± 6.65 (351-366)	17.3 ± 2.44 (14-20)	38	7.6 ± 3.38 (4-13)	
Peach	376.5 ± 16.50 (358-400)	8 ± 3.74 (4-13)	36	7.2 ± 3.06 (4-16)	
Willow	366.7 ± 11.44 (351-378)	11.3 ± 7.32 (1-17)	24	4.6 ± 2.15 (2-8)	
Mango	374 ± 18.55 (360 - 393)	4 ± 0.89 (3 - 5)	18	3.6 ± 1.74 (1 - 6)	
Fig	362.4 ± 4.36 (354-371)	7 ± 2.09 (3-9)	12	2.4 ± 1.50 (1-5)	
			F = 6.175 L.S.D. = 3.23 (At 0.01 level)		

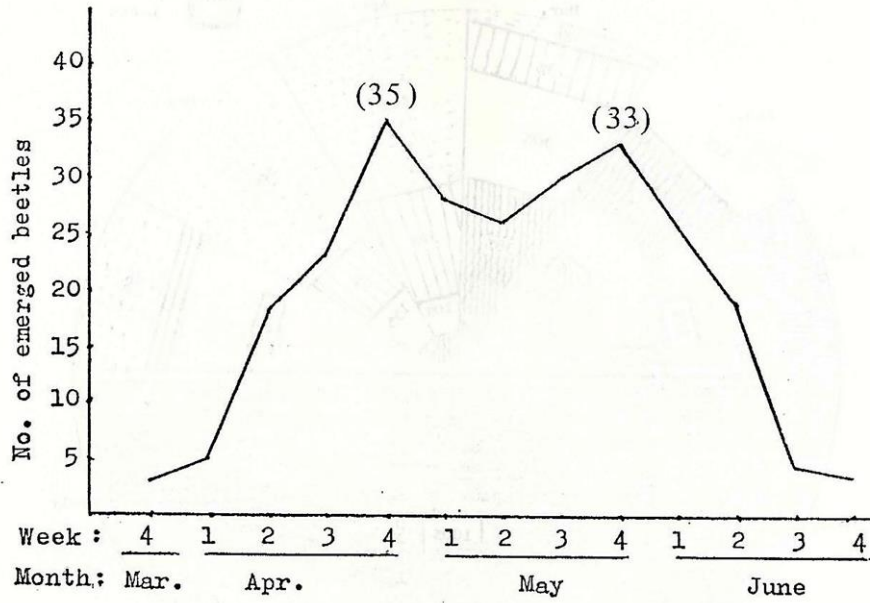


Fig. 1. Number of *A. congregata* beetles emerged from acacia cuttings from Fayoum Governorate in 1996.

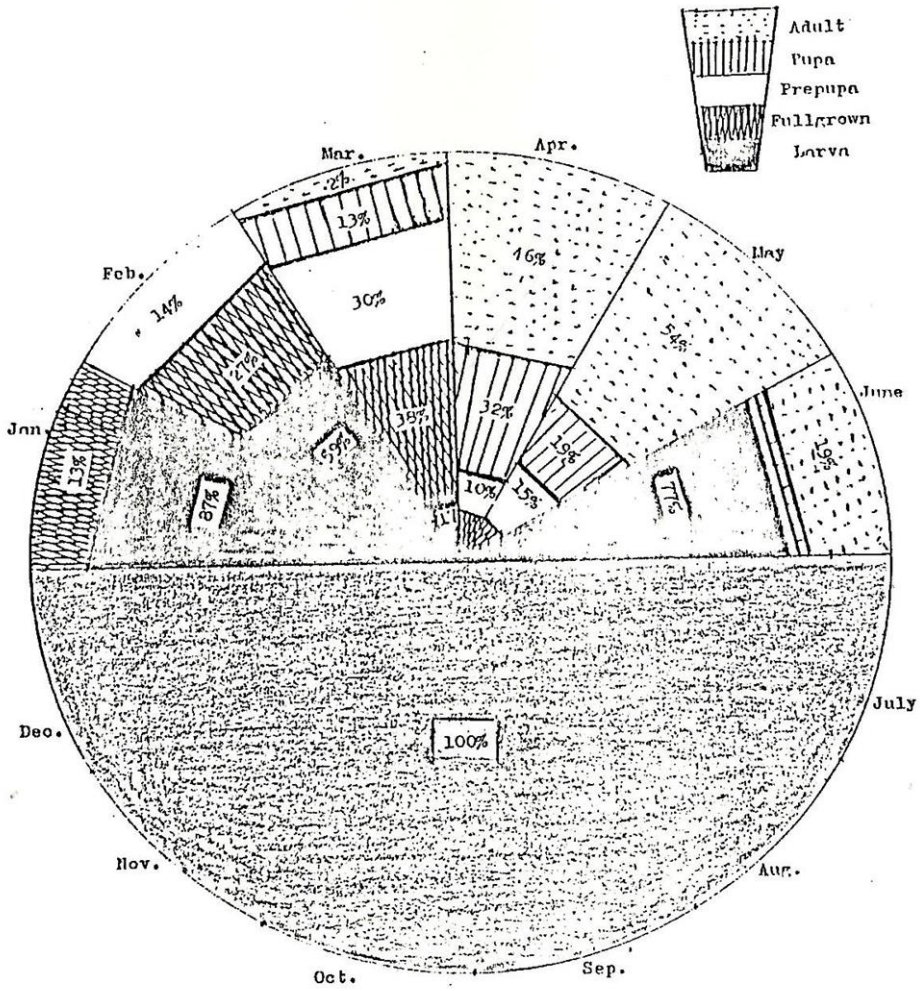


Fig. 2. Monthly percentages of the different developmental stages of *A. congregata* on acacia cuttings in 1996.

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ملاحظات معملية على الخنفساء المعدنية أنزاكسيا كونجريجاتا

عبد الغنى محمد بط

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - جيزة .

أوضحت الأبحاث المعملية أن الخنفساء المعدنية أنزاكسيا كونجريجاتا لها جيل واحد سنويا. وظهر تتبع التعداد قمتين واضحتين لحدوث الحشرات الكاملة عند نهايتى أبريل ومايو.

كانت العذارى والحشرات الكاملة متوفره من مارس إلى يونيو وقد وجد ارتباط معنوى موجب بين عدد الحشرات الخارجه والحراره العظمى، بينما كان تأثير الحراره الصغرى غير معنويا، وأظهرت الرطوبه النسبيّه علاقة سالبه مع عدد الخنافس الخارجة. كان تأثير الحراره الصغرى على تعداد اليرقات التامه النمو معنويا وسالبا وبالمثل كان تأثير الرطوبه النسبيّه على وفرة العذارى معنويا وسالبا.

كانت النسب المئوية للموت الطبيعى لليرقات والعذارى والحشرات الكاملة ٦,٩٪، ٣,١٪، ٢,٦٪ على التوالي، بينما كانت النسب المئوية للتطفل بواسطه طفيل كالسيديدى (غير مُعرّف) وخروج الحشرات الكاملة هي ١٩٪، ٧٠,٢٪ على التوالي.

اختلفت عدد الخنافس الخارجة باختلاف العائل حيث نتج العدد الاعلى للخنافس الخارجة (٤٢ خنفساء) من عقل الاكاسيا بينما نتج عدد أقل (١٢ خنفساء) من عقل التين. وقد تراوحت مده الجيل من ٣٥١ - ٤٠٠ يوما بينما امتدت فنره الخروج من ١ - ٢٠ يوما .