



Biological activities of developmental stages of citrus tree borer *Chrysobothris dorsata* (Buprestidae: Coleoptera) on casuarina trees.

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Abstract:

Chrysobothris dorsata (Fabricius) (Buprestidae: Coleoptera), female beetle put its eggs singly under the bark through crevices and cracks with trunks and branches of trees. The eggs are pale orange to pale brown in colour, semi-circular in shape, about 1.14x 1.095 mm. The incubation period lasted 5- 12 days with an average 8.5 ± 2.1 days. The larva of *C. dorsata* has six larval instars. The duration of immature larva ranged 280- 349 days (average, 313.8 ± 20.1 days), while duration of full-grown larvae ranged 9-22 days (average, 15.2 ± 4.5 days). The prepupal duration lasted 7-15 days (average, 10.3 ± 2.5 days). The duration of pupa ranged 9-18 days (average, 12.8 ± 2.8 days). The duration of adult stage inside the pupal chamber recorded 6-11 days (average, 8.2 ± 1.4 days). the beetles lived after emergence from host about 5-13 days (average, 7.9 ± 2.1 days). The averages of pre-oviposition, oviposition and postoviposition recorded 2.1 ± 0.8 days (ranged, 1-4 days), 3.8 ± 1.1 days (range 2 – 6 days) and 2.6 ± 0.8 days (range 1-4 days), respectively. The life cycle of *C. dorsata* beetle rearing in casuarina trees recorded 369.6 ± 18.9 days (ranged 346 – 405 days).

Introduction

Casuarina tree is one of important wood trees which are widely distributed in Egypt, which are cultivated on agriculture roads (as shade and ornamental trees) and around fields as obstacle or prevent the damage of crops by winds (Tawfik *et al.*, 2014). Buprestid beetle *Chrysobothris dorsata* (Fabricius) (Buprestidae: Coleoptera), is one of the most injurious pests of fruit and wood trees. According to Bedford (1931), Shalby (1958), Nour (1963), Alfeiri (1976), Moussa (1977), Batt (1989) and Okil (1991), this pest attack

acacia, citrus, lebbek, casuarina, common fig, mulberry, poincina, peach, apricot and mango trees. Therefore the aim of this work is to study the biology of this borer on casuarina trees.

Materials and methods

Infested casuarina branches with citrus tree borer, *C. dorsata*, were collected from Ismailia district (Ismailia Governorate), and put in wire cages (50x40x150cm). Continuous observations were carried out until starting adults emergence. Emerging beetles were collected and sexed. Each pair

(male and female) was put in glass jar (35cm. height and 18cm. diameter) on two cuttings of intact casuarina each of 25cm. long and 3cm. diameter. The ends of cutting were covered with wax and the bark at these ends were wounded by sharp blade (as oviposition sites). The beetles (10 couples) were observed until the females laid their eggs and the oviposition periods were recorded.

At hatching, the incubation period was estimated, and 30 hatching larvae were planted under the bark of other cuttings (larva /one cutting) to the same size of oviposition cuttings. The larvae were transferred to new cuttings at two intervals weeks until the larvae constructed the pupal chambers. The bark of cuttings was removed above larval tunnels to determine the number of instars by recording the molting skin, the duration of each instar was recorded. By removing to apart of wood tissues over pupal chambers, the different transformations of developmental stages were observed until emergence. The durations of different developmental stages were estimated,

whereas the life cycle of *C. dorsata* beetle was determined.

Results and discussion

Data on the biological aspects of citrus tree borer *C. dorsata* on casuarina trees showed the following results.

1. Egg stage:

The female beetle of *C. dorsata* put its eggs singly under the bark through the crevices and cracks with the trunks and branches of trees. The eggs are pale orange to pale brown in colour, semi-circular in shape, about 1.14 x 1.095mm.(Table,1). Okil (1991) found that eggs of *C. dorsata* are 0.6-0.8mm in diameter, while Batt (1999) recorded that the diameter of *C. dorsata* eggs about 0.89-1.27mm, with an average of 1.12 ± 0.09 mm.

Under laboratory conditions of 31.8 °C and 62.4 % RH. the incubation period lasted 5 to 12 days, with an average of 8.5 ± 2.1 days, Table (2), while Batt (1999) found that the incubation period of *C. dorsata* eggs on mango trees lasted 13.8 ± 3.33 days, ranged 8-19 days.

Table (1): Measurements of different developmental stages of *Chrysobothris dorsata* beetle on casuarina trees.

Stage	Length (mm.)		Width (mm.)	
	Range	Av. \pm s.e.	Range	Av. \pm s.e.
Egg	1 – 1.3	1.14 \pm 0.07	0.9 – 1.2	1.095 \pm 0.10
Larva	22– 27	24.6 \pm 1.7	5– 7	5.9 \pm 0.6 2
Prepupa	17 – 24	21.3 \pm 2.1	4.5 – 6	5.33 \pm 0.47
Pupa	14 – 16	14.7 \pm 0.09	4 – 5	4.33 \pm 0.40
Adult	13.8 – 14.5	12.8 \pm 0.2	3.8 – 4.6	4.1 \pm 0.3

Table (2): Durations of different developmental stages of *Chrysobothris dorsata* beetle on casuarina trees.

Stages	Duration (in days)		Lab.cond	
	Range	Av. \pm s.e.	Mean temp.°C	Mean RH. %
Egg	5 – 12	8.5 \pm 2.1	31.8	62.4
Immature larva	280 – 349	313.8 \pm 20.1	23.1	64.6
Full grown larva	9 – 22	15.2 \pm 4.5	26.2	60.7
Prepupa	7 – 15	10.3 \pm 2.5	28.8	61.2
Pupa	9 – 18	12.8 \pm 2.8	30.4	61.3
Adult hardness	6 – 11	8.2 \pm 1.4	30.6	62.4
Adult longevity	5 – 13	7.9 \pm 2.1	31.4	64.8
Total	346 - 405	369.6 \pm 18.9	28.9	62.5

2. Larval stage:

The newly hatched larvae bore under the bark through cambium tissue and external layer of sapwood marking larval galleries. The larval galleries are shallow, sinuous and filled with compact saw dust mixed with pellets of wood excrements.

As the larvae grow, the tunnels increase in length and width, until they reach to full grown larvae, which are typical buprestid larvae. The larvae of *C. dorsata* moult 5 times passing through six larval instars. Table (3) shows the dimensions of these instars.

Table (3): Dimensions of the larval instars of *Chrysobothris dorsata* rearing on casuarina cuttings.

Larval instar	Width of head capsule (mm.)		Length of body (mm.)		Width of body (mm.)	
	M ± SE	Range	M ± SE	Range	M ± SE	Range
First	0.44 ± 0.05	0.4 – 0.5	3.5 ± 0.11	3.4 – 3.7	0.77 ± 0.7	0.7 - 0.8
Second	0.88 ± 0.05	0.8 – 1.0	7.9 ± 0.7	7 – 9	1.65 ± 0.14	1.4 - 1.8
Third	1.26 ± 0.09	1.1 – 1.4	12.65 ± 0.85	11 – 14	2.8 ± 0.27	2.1 - 3.2
Fourth	1.72 ± 0.09	1.5 – 1.8	17.65 ± 1.19	15 – 19	3.86 ± 0.25	3.4 - 4.2
Fifth	1.97 ± 0.10	1.8 – 2.1	20.0 ± 1.0	19 – 23	4.77 ± 0.33	4.3 - 5.4
Sixth	2.69 ± 0.44	2 – 3.5	24.6 ± 1.7	22 - 27	5.9 ± 0.62	5 - 7

Okil (1991) mentioned that the length of full grown larva 18.4mm (16 – 23mm), while the width with 5.4mm (4.7mm, average), whereas Batt (1999) recorded that the length of full grown larvae ranged 19 – 33mm., with an average of 25.2 ± 5.2mm., while the width ranged between 5 – 7mm., with an average of 6 ± 0.56mm. Under laboratory conditions of 23.1°C and 64.6 % RH., the duration of immature larva ranged between 280 – 349 days, with an average of 313.8 ± 20.1 days (Table, 2).

Table (4) : Duration of the different larval instars of *Chrysobothris dorsata* under laboratory conditions.

Larva instar	Duration (in days)		Lab.cond.Av.	
	M. ± s.e	Range	Temp. °c	RH. %
First	60.8 ± 5.18	55 – 68	22.9	61.3
Second	49 ± 3.71	42 – 56	27.1	60.2
Third	55 ± 6.11	47 – 63	26.4	72.8
Fourth	69 ± 5.15	62 – 79	20.9	69.9
Fifth	80 ± 4.24	74 – 86	18.2	58.6
Sixth	15.2 ± 4.5	9 – 22	26.2	60.7
Total	329 ± 24.6	289 – 371	23.6	63.9

The length of first larval instar ranged 3.4 – 3.7 mm, with an average of 3.5 ± 0.11mm, while the body width ranged 0.7 - 0.8mm, with an average of 0.77 ± 0.7mm, whereas the width of head capsule ranged between 0.4 – 0.5 mm, with an average of 0.44 ± 0.05 mm. The length of full grown larva ranged 22 to 27mm., with an average of 24.6 ± 1.7mm., while the width ranged 5 – 7mm., with an average of 5.9 ± 0.62mm, whereas the width of head capsule ranged between 2- 35mm., With an average of 2.69 ± 0.44 mm.

Date presented in Table (4) show the duration of the different larval instars under laboratory conditions. The total duration of larval instars ranged between 289 – 371 days , with an average of 329 ± 24.6 days, under average lab. cond. of 23.6°C and 63.9 RH.% . When the full grown larva construct the pupal chamber in the sapwood., it transforms inside pupal chamber to prepupa which its length ranged between 17 – 24mm., with an average of 21.3 ± 2.1mm., while the width ranged between 4.5 – 6mm., with an average of 5.33 ± 0.47mm. (Table,1).

Under laboratory conditions of 26.2°C and 60.7 % RH., the duration of full grown the larva ranged 9-22days, with an average of 15.2 ± 4.5 days, while the prepupal duration lasted 7 –15days, with an average of 10.3 ± 2.5 days under laboratory conditions 28.8°C and 61.2 % RH. (Table , 2). Batt (1999) reported that the larval duration of *C. dorsata* inside mango trees, ranged 287 – 309 days with an average of 297.4 ± 4.83 days, under laboratory conditions of 25.2°C and 66.3 % RH., while he recorded that prepupal duration lasted 14.5 ± 5.8 days (ranged between 7 – 22 days), under laboratory conditions of 27.1°C and 60 % RH.

3. Pupal stage:

The prepupa transforms inside pupal chamber to pupa which its length ranged between 17 – 24mm, with an average of 21.3 ± 2.1 mm, while the width ranged between 4.5 – 6mm with an average of 5.33 ± 0.47 mm. (Table,1). Okil (1991) mentioned that the length of pupa (rearing on citrus trees) was 14.1mm (13 – 19mm), while the width 5.3mm (4 – 7 mm), whereas Batt (1999) found that the average length of pupa of *C. dorsata* (rearing on mango trees) was 14.7 ± 0.9 mm (ranged 13 – 16mm), while the average width 4.39 ± 0.41 mm (ranged 4 – 5 mm). Under laboratory conditions of 30.4°C and 61.3% RH., the pupa elapsed about 9 – 18 days (average, 12.8 ± 2.8 days) to transform to adult inside pupal chamber, (Table, 2). In this respect, Batt (1999) recorded that the pupal duration of *C. dorsata* rearing on mango trees was about $16.14 \pm$

8.57 days (ranged 5 – 25days) under laboratory condition of 27.1°C and 60 % RH.

4. Adult stage:

The adult that formed inside the pupal chamber stays a period varied between 6 – 11 days, with an average of 8.2 ± 1.4 days for hardness (under laboratory conditions of 30.6°C and 62.4% RH.) in the same chamber before its emergence from the host. The beetle lived for ranged between 5 – 13 days, with an average of 7.9 ± 2.1 days, under laboratory conditions of 31.4°C and 64.8% RH. Table (2), Similar results obtained by Batt (1999) who recorded that hardness period of *C. dorsata* (inside mango trees) ranged 4 –11 days (average 8.33 ± 2.3 days), while the beetle lived 3 – 14 days with an average of 7.4 ± 3.87 days.

The length of adult ranged between 12.8 – 14.5mm., with an average of 13.5 ± 0.2 mm., while the width ranged between 3.8 – 4.6mm.,with an average of 4.1 ± 0.3 mm. (Table,1). Okil (1991) found that the length and width of *C. dorsata* beetle ranged between 4 –14mm. and 4 – 6 mm. respectively, while Batt (1999) found that the length of adult ranged between 13.5 – 14.5mm.(average, 13.9 ± 0.4 mm),While the width ranged between 4 – 5mm. (average, 4.2 ± 0.43 mm.).Under laboratory conditions of 31.8 °c and 62.4% RH., the average periods of preoviposition, oviposition and postoviposition recorded 2.1 ± 0.8 days (range, 1 – 4 days), 3.8 ± 1.1 days (range, 2 – 6 days) and 2.6 ± 0.8 days (1 – 4 days), respectively (Table,5).

Table (5) : Ovipositional periods of *Chrysobothris dorsata* under laboratory conditions of 31.8 °C and 62.4 % RH.

State	Duration (in days)	
	Range	Av. \pm s.e.
Pre-oviposition	1 – 4	2.1 ± 0.8
Oviposition	2 – 6	3.8 ± 1.1
Post-oviposition	1 – 4	2.6 ± 0.8

The results revealed that the life cycle of *C. dorsata* beetle rearing on casuarina trees recorded 369.6 ± 18.9 days ranged 346 - 405 days, under laboratory conditions of 28.9°C and 62.5% RH., Table (2). This result is coinciding with Batt (1999) who reported that only one generation of *C. dorsata* beetle occurs each year on mango trees, where the total duration of life stages was 357.30 ± 28.8 days, ranged between 314 – 400 days.

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