



Study on Biology of Pomegranate Playboy *Deudorix livia*, (Klug, 1834) in *Acacia Farnesiana*

KEYWORDS

Developmental stage, green *Acacia* pods, *Deudorix livia* K.

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ABSTRACT An experiment was conducted to study the biology of pomegranate playboy *Deudorix livia*, (Klug, 1834), under laboratory condition. *Acacia* green pods were used as host plant for studying biology of the insect. It was found that the average length of egg and 1st, 2nd, 3rd, 4th and final instar larva were 0,52 +/-0.001 mm, 1.48 +/-0.005 mm, 4.14 +/-0.008 mm, 7.80 +/-0.008 mm, 11.93 +/-0.007mm and 16.15 +/-0.01 mm, for male and female pupa the average length is 8.09 +/-0.007mm and 10.9 +/-0.007 mm respectively. Larval period, pupal period and total development were 14.7 +/-0.02 days, 9.84 +/-0.02 days and 29.41 +/-0.09 days respectively.

Introduction

Among the major insect pests of pomegranate, *Deudorix livia*, (Klug, 1834) (Lepidoptera, Lecanidae) is one of the most important pest. The pomegranate butterfly is widely distributed throughout the Arabian Peninsula reaching the Mediterranean Coast in Egypt, Israel, Lebanon and Syria and Recently in Europe. (Tolman, 2001; Williams, 1971).

The butterfly occurs also on *Acacia farnesiana* pods, *Prunus salicina*, *Eriobotrya japonica*, *Psidium* spp. and occasionally on olive flowers (Katbeh-Bader et al., 2003).

After its detection in 2006 in Tunisia (Ksentini et al., 2011), *D. livia* has been shown to coexist on pomegranate (*Punica granatum*) and *Acacia* as windbreaks within the same grove (Mkaouer et al., 2014).

D. livia is reported to have three generation on *A. farnesiana* in Tunisia, after this, the adult migrate to his secondary host, *Pinus granatum* when *acacia* pods gets dry and a new generation starts (Mkaouer et al. 2014; 2016). However, in the Middle East, on both *Acacia* and *Pinus*, this pest can develop between six and eight generations (Avidov, 1958; Awadallah, 1966).

Deudorix livia alternated all the year from host to another due to the specificity of the floor culture in Southern Tunisia and this supplies the major portion of food for the butterfly during its cycle.

The larvae of *Deudorix livia* causes considerable damage to pomegranate during all stages of development producing characteristic holes which help in rotting and subsequent attack of diseases of the fruits. Adults feed on *acacia* seed and later on pomegranate fruits and date palm (personnal observation) there by lowering the yield substantially.

No statistical records are available on the actual loss of the crops due to the attack of the pest. However, in 2006, 5.2% of all pomegranate fruits were produced in Tunisia infested, over 52% of pomegranate products in the locality of Zerkine were rotten (Ksentini et al., 2011).

For the selection and execution of any plant protection program on the management of the pest, it is the basic requirement to study the biology of the pest.

It is essential to have a fair knowledge on its behavior and growth pattern, which will help to ascertain the appropriate control measures for the management of the pest by reducing its population and damage to plants. Therefore, the present study was undertaken to investigate the biology of *Deudorix livia* on *Acacia farnesiana* pods under laboratory condition.

Materials and Methods

The experiments were conducted on the biology of *D. livia* in the Laboratory of Forest Management and Resource Development in the National Institute for Research in Rural Engineering, Water and Forest during 3 consecutive years from April to July. The prevailing room temperature was 25 ± 1°C.

The species of *Acacia farnesiana* used in the experiment were provided from windbreak tree in Zerkine (33° 40' N and 10° 15' E), Metwia (33° 57' N and 9° 59' E) localities in Gabès region and Gafsa through ksar locality (34°24' N 8°48' E) in the western south of Tunisia. The collected pods were transported to the laboratory and divided into plastic boxes by date of sampling and localities.

The study was initiated utilizing larvae collected in the field, the specimen were placed in plastic boxes, covered with a perforated lid and lined with voile tissue for aeration. Every 2 days, the specimens were observed under a stereoscopic microscope. The duration and viability of instars were evaluated. The newly emerged adults were sexed.

The larvae were observed daily until pupation to record the number of larval instars and their duration. The pupae were kept in the respective boxes until the adult emergence to record pupal period. The length of larvae at each instars and pupae were measured and recorded. The data analyses were presented as mean ± S.E (Standard Error).

Results and Discussion

Egg of *Deudorix livia*

During the 3 years of study, we obtain any oviposition of fertile eggs. In nature, eggs are laid most of the time singly on the peduncle of green pods; the egg was circular in shape, white in color with slightly grey tint. The length of

the eggs varied from 0.5 mm to 0.65 mm with an average of 0.52 ± 0.001 mm (Table1)

Larva of *Deudorix livia*

The newly born larva hollow a hole in the pod skin to enter and to clear out feces during its development.(Fig.1) When in Acacia pods the larva feeds on the seeds, hence in pods measuring minimum 25 mm, the exit hole is no more than 2 mm whereas in large pods with maximum 70 mm of length, containing an adequate number of seeds for a complete development the exit hole can reach 6 mm. In rarely cases, we can found two holes in the same Acacia pods. These results were in accordance with that found by Avidov (1958).



Fig 1. *Deudorix* larva feeds on Acacia seeds and piles their excrement

Larva of *Deudorix livia* molted four times and had five larval instars. Just after hatching the larvae was yellow greenish, the anal portion was gray in color and its sides are hairy with long black hair in the top and dark gray edges. The larvae were measured maximum 2 mm and minimum 1 mm in length with an average of 1.48 ± 0.005 mm (Table 1).

The average duration of 1st instar larvae was 4.58 ± 0.01 days (Table 3). The average body length of the 2nd instar larvae was 4.14 ± 0.008 mm with maximum 5 mm and minimum 3.0 mm (Table 1).

Table 1. Morphometric measurement of different developmental stages of *Deudorix livia*

Different stages of life cycle	Lenght (mm)		mean +/-SE
	min	max	
Egg	0.5	0.65	0,52 +/-0.001
1st instar larva	1	2	1.48+/-0.005
2nd instar larva	3	5	4.14+/-0.008
3rd instar larva	7	9	7.80 +/-0.008
4th instar larva	11	13	11.93 +/-0.007
5th instar larva	14	18	16.15+/-0.01
Male pupa	7	9	8.09+/-0.007
Female pupa	10	12	10.9+/-0.007

Table 2. Duration of different developmental stages of *Deudorix livia* on *Acacia farnesiana* under laboratory condition.

Different stages of life cycle	Duration		mean +/-SE
	min	max	
1st instar larva	2	9	4.58+/-0.01
2nd instar larva	1	6	3.45+/-0.01
3rd instar larva	3	6	3.78+/-0.009
4th instar larva	2	6	3.25+/-0.01
5th instar larva	3	6	4.18+/-0.01
Total larval period	10	20	14.7+/-0.02
Pupal period	8	16	9.84+/-0.02
total development period from larva to adult	21	57	29.41+/-0.09

It was easily distinguishable from the first instar larvae by size. The duration of 2nd instar was 3 to 5 days with an average of 3.45 ± 0.01 days (Table 2). The third instar larvae measured maximum 9.0 mm and minimum 7 mm in length with an average of 7.80 ± 0.008 mm.

Feeding of the larva increased at this instars and their movement was difficult to detect inside the pod otherwise the ejection of faecal pellets. The duration of the 3rd instar larvae ranged from 3 to 6 days with an average of 3.78 ± 0.009 days (Table 2).

This instars is colored green until the end of the growth, and then turns brown-red; the color of the body depends on the feeding host color, grayish tint (Acacia) to purple-faded (Pomegranate).

The fourth instar was elongate and slightly broader towards anterior region. Head was small as compared to the body and brown in color.

During this instar, the larvae takes maximum food and feed voraciously all the seeds until complete development.

Later on after feeding the full-fed larvae assumed the cylindrical shape unlike the first instar. The length of this instar ranged from 11.00 mm to 13.00 mm with an average of 11.93 ± 0.007 mm.

Duration of 5th or full-fed larvae ranged from 3 to 6 days with an average of 4.18 ± 0.01 days. The total larval period ranged from 10 to 20 days with an average of 14.7 ± 0.02 days (Table 2). The present findings were not complying with the findings of Avidov (1958); he reported an average of larval period of 24.2 to 22.5 days respectively in April and May, period when the butterfly activity was studied in Tunisia.

Avidov stated also the larval size according to five distinct groups corresponding to each larval instars which varied from 1.5 to [15-18] mm. In our study, Just after hatching the Larvae measured 1.48 mm in length on an average. Length of the full larvae was from 14 to 18.00 mm, respectively.

Pupa of *deudorix livia*

At the end of its development, the fifth larvae instar

stopped feeding and then moved from the pods to outside for pupating. It constructed whitish oval prepupae. It then remains 2 days after having the final pupa which was smooth and brown in color.

The length of the pupa ranged from 10 mm to 12 mm for female and 7 to 9 mm for male with an average of 10.9 ± 0.007 mm and 8.09 ± 0.007 mm respectively. The average duration of the pupal period was 9.41 ± 0.03 days with maximum 16 days and minimum 6 days. (Table 2) The present findings were in agreement with the results of Avidov (1958). The average of pupal period on *Acacia farnesiana* was 16.5, 10, 8 respectively in April, May and June and the pupa measured 11-12 mm.

Adult of *deudorix livia*

Fully developed female was golden brown in color with blue spots in the wings base. In each of her back wings there is a black spots coupled with the "tails" which makes it almost appear as an insect head with eyes and antennae.

In case of male, it is brilliant orange-gold. The front wings corners are dark brown and each hind wings have tail near a black spot.

The bottom side in both wings is gray with white paintings in black and white in brown. At the base of the hind wings and close to the body there are small black spots. The lower wings edges, near the tail, has a large black spot.

Maximum population of the insect is observed during May and June on *Acacia farnesiana* and then it shows a downward trend, the population again exhibits an upward trend in September on pomegranate and thereafter there is a gradual decline in population. The adult population persists up to the middle of November.

Conclusion

The present study was conducted to study the biology of *Deudorix livia* to establish the best practices for an integrated pest management program.

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