

## Biology of Anar butterfly: *Deudorix (Virachola) isocrates* Fabricius (Lepidoptera: Lycaenidae) in mid hill of Himachal Pradesh

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### ABSTRACT

The studies on biology of fruit borer, *Virachola isocrates* Fabricius carried out under laboratory conditions revealed that gravid female lays shiny white eggs singly on the calyx of flowers or on young fruits and on leaves. The average incubation period was recorded to be of  $8.66 \pm 2.05$  days. The developmental period of first, second, third, fourth and fifth instar was  $2.66 \pm 0.46$ ,  $3.33 \pm 0.46$ ,  $3.66 \pm 0.46$ ,  $3.33 \pm 0.46$  and  $3.33 \pm 0.46$  days, respectively. The total larval period was found to be of  $15.33 \pm 6.94$  days. Pupal stage found to be  $15.33 \pm 6.94$  days. Total developmental period was completed within  $40 \pm 4.08$  days through five larval instars on pomegranate.

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**Keywords:** Anar Butterfly, Biology, pomegranate

### 1. INTRODUCTION

Pomegranate (*Punica granatum* L.) is one of the important commercial fruit crop of the tropical and sub-tropical regions of the world. In India, pomegranate is grown on 2, 34, 000 ha area with a production of 28, 45, 000 MT (Anonymous 2018). Due to the high economic returns being obtained with pomegranate, the area under pomegranate cultivation in Himachal Pradesh has increased to 2,847 hectares with a production of 3,215 MT (Anonymous 2019). In India, pomegranate is attacked by more than 45 insects (Butani, 1979) of which Pomegranate butterfly *Deudorix (Virachola) isocrates* is one the most obnoxious pest and has been reported to cause 40-90 per cent damage to pomegranate fruits (Atwal, 1986).

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During last decades, pomegranate crop has witnessed a tremendous growth potential in mid hill zone Himachal. However, its cultivation is adversely affected by Pomegranate butterfly, *V. isocrates*. It is a direct pest of regular occurrence, the caterpillars of which bore into developing fruit and feed on the seeds. The hole made by the larva invites secondary infection causing fruit to rot and drop. For management of pest, the basic requirement is to have a good knowledge of biology, important characteristics and feeding behavior of the pest. The present study was undertaken to investigate biology of *V. isocrates* along with other parameters under laboratory conditions.

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### 2. METHODOLOGY

Study on the biology of *V. isocrates* was carried out under laboratory conditions in the Horticultural Research Station, Dr Y S Parmar University of Horticulture and Forestry, Seobagh Kullu 2020. The developing fruits having small entry holes were collected from the unsprayed pomegranate plants and were kept in glass cages. The fresh food material (pomegranate fruits) was provided timely to ensure a good emergence of adults. After adult emergence, the male and female butterflies in 1:1 ratio were transferred to glass jars covered with muslin cloth. Cotton swab soaked in sugar solution (10%) was provided as a source of food. In each jar, pomegranate twigs having developing fruits and flowers were provided as substrate for oviposition. The eggs laid by females were removed from substrate with the help of camel brush and transferred to Petri plates containing moist filter paper to maintain a regular regime of moisture. Ten such Petri plates were maintained each having a group of about ten eggs. The observations on incubation period were recorded. After hatching, ten neonate first instar larvae were transferred individually to developing fruits of pomegranate and kept in separate small containers. The change in colour and other morphological features were considered as indicators for the change of instars. Up to second instar, immature fruits were provided as food, but for third, fourth and fifth instars, developed fruit was given as food and these were shifted to glass jars. The food material was replaced regularly till the larvae pupated. We recorded observations on duration of different larval instars along with some important larval characteristics. After pupation, the pupae were removed within 2-3 days when cuticle had hardened, and kept in separate glass jars till adult emergence. Measurements of different stages i.e. the egg, the larvae, the pupae and the adult were regularly recorded with the help of ocular micrometer and stage micrometer. The observations on incubation period, larval period, pupal period and total developmental period were also recorded.

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### 3. RESULTS AND DISCUSSION

The results pertaining to different parameters of biology of *V. isocrates* are presented in (Table1). Studies showed that total developmental period was completed within  $40 \pm 4.08$  days through five larval instars on pomegranate under

laboratory condition. The experimental data revealed that the female laid eggs on flowers, fruits (base, middle, top and calyx cup) and on leaves singly. The freshly laid eggs were shiny white in colour and more or less round in shape. In life cycle studies of *V. isocrates* Fabricius (The Anar butterfly) results are in conformity with the description of some earlier investigations for example Bhut *et al.* (2013) who studied the life cycle of *V. isocrates* and stated that the female laid eggs on flowers, fruits and leaves singly. The freshly laid eggs were shiny white in colour. The length and breadth of eggs, first, second, third, fourth, fifth instar larvae, pupa and adult were also measured. The larvae were found to pass through five instars on pomegranate fruits in the laboratory. The average length and breadth of eggs measured  $0.47 \pm 0.014$  mm and  $0.50 \pm 0.045$  mm, respectively. The incubation period varied from 6 to 10 days with an average of  $8.66 \pm 2.05$  days. These findings are well supported by Karuppuchamy *et al.* (1998), Singh and Singh (2001), Tiwari and Mishra (2007), Kumar *et al.* (2017), Bhut, *et al.* (2013), Mallikarjun and Pal (2018) who also noticed five instars of this pest. In laboratory, the newly hatched first and second instar larvae fed initially on seed. The third instar larva bore hole was bigger in size and posterior end of the abdomen was seen through the bore hole. The fourth instar fed voraciously on seeds and excreta was pushed out of the entry holes as dry pellets or wet faecal matter which stunk around the holes. This could create an offensive smell. The fifth instar larva was creating lot of mess and offensive smelling fluid oozed out from the entrance hole. Sometimes, the holes could be plugged with the anal end of larva. The larvae were found to pass through five instars on pomegranate fruits in the laboratory. These findings are well supported by Thirumurugan (1992), Karuppuchamy *et al.* (1998), Singh and Singh (2001) and Tiwari and Mishra (2007) who noticed five instars of this pest in contrast to Kabre and Moholkar (1992) who observed only four instars of *V. isocrates* on pomegranate. The freshly hatched larva was cylindrical and creamy white in colour except head and last abdominal segments being black. The body of larva covered with scattered white hairs. The average length and breadth of first instar larva measured  $1.55 \pm 0.02$  mm and  $0.95 \pm 0.017$  mm, respectively. The width of head capsule measured  $0.20 \pm 0.017$ . The duration of first instar larvae varied from 2 to 3 days with an average  $2.66 \pm 0.46$  days (Table 1).

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The colour of second instar larva varied from creamy white to greenish brown with scattered hairs. The average length of second instar larva measured  $6.94 \pm 0.037$  mm, while the breadth measured  $2.44 \pm 0.044$  mm. The width of head capsule measured  $2.44 \pm 0.044$  mm and duration of second instar larvae varied from 2 to 4 days with an average  $3.33 \pm 0.46$  days

Third instar larva was similar to preceding instar but dark in colour with larger yellowish and boat shaped spots on abdomen. The average length, width and head capsule width of third instar larva measured  $12.23 \pm 0.62$  mm,  $3.77 \pm 0.044$  mm and  $0.52 \pm 0.014$  mm, respectively. The average duration of third instar larvae was  $3.66 \pm 0.46$  days.

The yellowish boat shaped spots disappeared in the stout fourth instar larva. The colour changed greenish to light brown. The average length, width and head capsule width of fourth instar measured  $16.9 \pm 0.4$  mm,  $4.46 \pm 0.26$  mm and  $0.80 \pm 0.02$  mm, respectively. While, average duration of fourth instar larvae  $3.33 \pm 0.46$  days.

The full grown larva was dark brown with pale yellowish patches and short hairs on the body. Full grown larva suspended its feeding, become motionless. The average length, width and head capsule width of fifth instar larva measured  $22.3 \pm 0.58$  mm,  $5.77 \pm 0.017$  mm and  $1.15 \pm 0.017$  mm, respectively. The average duration of fifth instar larvae  $3.33 \pm 0.46$  days.

The total larval period varied from 26 to 34 days with an average  $30.58 \pm 0.82$  days. The present findings are in conformity with Butani (1976) noted total larval period ranged from 18 to 47 days. Karuppuchamy *et al.* (1998) mentioned total larval period ranged from 19 to 25 days.

The larvae pupated inside the damaged fruit or in tunnel made by the larva. The pupa of *V. isocrates* was light brown in colour, obtect and adecticous in shape. The average length of pupal  $13.79 \pm 0.028$  mm, while breadth  $6.06 \pm 0.094$  mm. The average duration of pupal stage  $15.33 \pm 6.094$  days.

The total developmental period of *V. isocrates* occupied on an average  $40.0 \pm 4.08$  days ranging from 30 to 42 days. Similar observations reported by Karuppuchamy *et al.* (1998) and Shevale (2003). Whereas, Khan (2016) observed total developmental period of 30 to 60 days with mean of  $46.50 \pm 2.91$  days on guava and Kumar *et al.* (2017) recorded total developmental period of 52 to 75 days with mean of  $63.92 \pm 2.87$  days on pomegranate.

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Adult butterflies were dull brown (males) to dark brown (females). The fore wings of both sexes covered with brownish scales were large in size and dark in colour as compared to hind wings which had long tail like structure on its anal margin. The thorax was fairly large and covered with brownish hairs. Male butterfly had three bluish spots in the anterior region of each hind wing. The female butterflies had an orange patch on the apical region of each forewing. The average length of female butterfly  $24.56 \pm 0.86$  mm, while breadth expanded  $44.7 \pm 0.82$  mm. Adult butterflies lay eggs on flowers and fruits. Eggs are exposed outside until hatching and after hatching, the first instar larvae remain outside for some time before puncturing the fruit. Therefore, efficient control can be achieved by properly timing the sprays when eggs or young larvae are still on the fruits. Hence, location-specific studies on *V. isocrates* are necessary for implementing a good pest management strategies.

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**Table: 1 Duration of different life stage and Morphometric of *V. isocrates* on pomegranate under laboratory condition**

Developmental stages	Mean duration (Days)	Range	Body Dimensions (mm)
Egg	8.66 ± 2.05	6-10	Length = 0.47 ± 0.014 Width = 0.50 ± 0.45
I <sup>st</sup> instar	2.66 ± 0.46	2-3	Head Capsule Width = 0.20 ± 0.017 Body Length = 1.55 ± 0.02 Body Width = 0.95 ± 0.017
II <sup>nd</sup> instar	3.33 ± 0.46	2-4	Head Capsule Width = 0.31 ± 0.014 Body Length = 6.94 ± 0.037 Body Width = 2.44 ± 0.044
III <sup>rd</sup> instar	3.66 ± 0.46	2-6	Head Capsule Width = 0.52 ± 0.014 Body Length = 12.23 ± 0.62 Body Width = 3.77 ± 0.044
IV <sup>th</sup> instar	3.33 ± 0.46	2-5	Head Capsule Width = 0.80 ± 0.02 Body Length = 16.9 ± 0.4 Body Width = 4.46 ± 0.26
V <sup>th</sup> instar	3.33 ± 0.46	2-8	Head Capsule Width = 1.15 ± 0.017 Body Length = 22.3 ± 0.58 Body Width = 5.77 ± 0.017
Total Larval period	30.58 ± 0.82	26-34	-
Pupa	15.33 ± 6.94	8-19	Length = 13.79 ± 0.028 Width = 6.06 ± 0.094
Total developmental period	40 ± 4.08	30-42	-
Adult (Female)	-	-	Length = 24.56 ± 0.86 Wing Span = 44.7 ± 0.82