Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2564

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (1):** 498-503 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Biology of Anar Butterfly, *Deudorix isocrates* (Fab.) (Lycaenidae: Lepidoptera) on Pomegranate, *Punica granatum* L.

K. P. Kumar[1*], P. D. Kamala Jayanthi[2], S. Onkara Naik[2], Abraham Verghese[3] and A. K. Chakravarthy[2]

[1]Department of Agricultural Entomology, University of Agricultural Sciences, Gandhi Krishi Vignan Kendra (GKVK), Bengaluru-560065, Karnataka, India

[2]Division of Entomology and Nematology, Indian Institute of Horticultural Research, Hesseraghatta Lake PO, Bengaluru-560089, Karnataka, India

[3]GPS Institute of Agricultural Management, Bengaluru- 560 058, Karnataka, India

*Corresponding Author E-mail: kumarkp4830@gmail.com

Received: 8.02.2017 | Revised: 20.02.2017 | Accepted: 21.02.2017

ABSTRACT

Pomegranate butterfly, Deudorix isocrates is one the most obnoxious pest on pomegranate crop incurring about 65-70 percent of yield loss worldwide. However, the experiment was conducted on biology of pomegranate fruit borer at the laboratory of Division of Entomology and Nematology, ICAR-Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru during 2013-14. Biological studies revealed that gravid female lays shiny white eggs singly on the calyx of flowers or on young fruits. The incubation, larval, prepupal and pupal periods were 7.15 ± 0.10, 32.9 ± 2.38, 4.35 ± 0.12 and 10.25 ± 0.10 days respectively. The adult longevity of male and female was 8.26 ± 0.14 and 10.28 ± 0.20 days respectively. Sexual dimorphism was observed in adults. D. isocrates took about 52-75 days with on an average 63.92 ± 2.87 days to complete life cycle from oviposition to adult emergence on pomegranate.

Key words: *Anar Butterfly, Adult longevity, Biology, Deudorix isocrates (Fab.), Pomegranate*

INTRODUCTION

Pomegranate, *Punica granatum* L. is emerging as commercially important fruit crop in tropical and sub-tropical regions of the world, serving dietetic, remedial and aesthetic values. In the last three decades, area under pomegranate cultivation, production and export of fruit has significantly increased because of its versatility, hardy nature, wider adaptability, drought resistance, higher yields, excellent keeping quality, remunerative prices, less requirement of water and availability of vegetatively propagated planting materials[1]. In India, it is cultivated in 1,43,140 ha with a production of 17,73,660 MT with an average productivity of 12.39 MT. It has been considered as a vital cash crop in Karnataka with a 19,040 ha and with production of 2,04,640 MT with an average productivity of 10.75 MT[2].

Cite this article: Kumar, K.P., Jayanthi, P.D.K.,Naik, S.O., Verghese, A. and Chakravarthy, A.K., Biology of Anar Butterfly, *Deudorix isocrates* (Fab.) (Lycaenidae: Lepidoptera) on Pomegranate, *Punica granatum* L., *Int. J. Pure App. Biosci.* **5(1):** 498-503 (2017). doi: http://dx.doi.org/10.18782/2320-7051.2564

Several insect and non-insect pests are known to attack pomegranate crop, among them, Pomegranate fruit borer, *Deuodorix isocrates* (Fab.) is a major constraint in the production of appropriate quality fruits of pomegranate for domestic and export markets[3]. It is also commonly called as Anar butterfly or Pomegranate butterfly causing more than 50% yield loss[4] and is, in fact, a polyphagous pest attacking a wide range of host plants, including anola, guava, citrus, litchi, peach, pear, apple, ber, tamarind and sapota[5, 6]. The above statiscal loss due to Anar butterfly, its alarming time to study the biology of *D. isocrates* in order to manage this pest. Hence, the present investigation was conducted at ICAR-Indian Institute of Horticultural Research, Bengaluru, during 2013-14.

MATERIAL AND METHODS

Study on the biology of *D. isocrates* was carried out in the laboratory of the Division of Entomology and Nematology, ICAR-Indian Institute of Horticultural Research, Bengaluru ($12^0$58'N and $77^0$35'E; 890 m MSL) during August to December, 2013-14 at ambient temperatures and RH. Larvae and pupae contained in infested fruits were collected from pomegranate orchards planted at ICAR-IIHR and Gandhi Krishi Vignan Kendra (GKVK), Bengaluru and kept in plastic containers for insect rearing. Ten plastic containers and each container containing three fruits were maintained under laboratory conditions. To study the larval and pupal development, observations were made on larval instars and pupation. Freshly emerged male and female insects were differentiated based on their morphological characters, a pairs of emerged insects were relesed in each wooden cages of wire mesh (46.5 x 46.5 x 46.5 cm) and ventilated glass (60 x 60 x 60 cm) by providing pomegranate branches, bouquets of flowering weed, *Tridax procumbens* L. were placed in 500 ml conical flask with water to mimic natural ambience and fed with 10 per cent honey solution soaked in cotton swabs to record the longevity of adults (Figure 1a). Observations were recorded on duration of egg, larvae of each instar, pre-pupa, pupa and adult stages. For the study of morphometrics, *viz.,* the size of egg, larvae, Pre-pupa, pupa, male and female adults, and body length was obtained using an ocular micro-meter. The mean temperature and relative humidity during the period of study were also recorded.

RESULTS AND DISCUSSION

The experimental data revealed that the gravid female laid round white eggs singly but also sometimes in pair either on the fruit or on the calyx, on the stalk or on upper surface of leaves (Figure 1b, c & d). The freshly laid eggs on an average measured 0.55 ± 0.30mm in diameter (Table 2). The incubation period lasts for 6-8 days with average period 7.15 days (Table 1) at 24.8 - 32.5^0C and 86-90% RH. Present results were in confirmation with earlier workers who reported that shiny white eggs singly on the calyx of flowers or on small fruits and incubation period lasts for 8-10 days with average period of 8.8 days [6, 7, 8]. Average egg diameter varied 1.22 ± 0.11mm and the incubation period was 8.0 ± 1.2 days.

Freshly hatched larvae were cylindrical with creamy white except head and last abdominal segments being dark. The body of larva with short scattered white hairs, measured 1.25 - 1.85mm in length and 0.60 - 1.10mm in width (Table 2). The development period of this instar was 6.10 ± 0.15days (Table 1) at 22.5 - 31.4^0C and 86.5% RH. The second instar larvae turned creamy white to greenish brown with scattered hairs and pale yellowish patches on the body (Figure 1e & f). It measured 6.59 ± 0.61mm in length and 2.43 ± 0.49mm in width. This instar lasted 7.20 ± 0.26 days (Table 1) at 21.7 - 32.4^0C and 88% RH. Third larval instar resembled second instar except the length increased 12.09 ± 2.23mm and width of 3.82 ± 0.53mm (Table 2) with the development period of this instar was 7.50 ± 0.32 days (Table 1) at 23.9 -33.4^0C and 89% RH. Last abdominal segment was slanting and flat segments forming a shield over the anus in the full-grown larva.

Fourth instar larva was light brown and measured 18.01 ± 1.26 mm in length and 5.12 ± 0.43mm in width. The average duration of fourth instar was 6.20 ± 0.35 days (Table 1). Previous studies revealed that the fourth instar larva lasting 4.97 days[10]. Fully mature larva was blackish brown with pale yellowish patches and short scattered hairs all over the body. The developmental period of fifth instar

lasting of 5.90 ± 1.30 days (Table 1) and measured 21.07 ± 1.32mm in length with 6.36 ± 0.54mm in width (Table 2) at 21.00 to 32.5°C and 89% RH. Thus, total larval period on pomegranate was of 32.9 ± 2.38 days with an average duration of 27-41 days. Total larval period of 17-46 days with mean duration of 31.4 days on pomegranate[6]. The larva passed through five instars and the total larval period was 17-22 days[5, 11].

On hatching, the larvae bores inside the developing fruits and are usually found feeding on the pulp and seeds just below the rind. The affected fruits ultimately fall down and are of no use. Pomegranate fruits with punctures caused by borer are most suitable for the entry of microorganisms responsible for their rotting (Figure 1i). The larvae of *D. isocrates* pass through five instars to reach pre-pupal stage[7, 12]. Before pupal stage, the larval colour changed from dark brown to dark bluish on dorsal side and dirty on ventral side, shrunken, stopped feeding and turned into pre-pupal stage which measured 17.31 ± 1.73mm in length with 8.22 ± 0.51mm in width (Table 2). This stage lasted for 4.35 ± 0.12 days (Table 1). The pupa is obtect, light to dark brown in colour, measured 14.25 ± 0.82mm in length and 6.59 ± 0.91mm in width (Table 2). Pupation takes place inside the damaged fruit (Figure 1g). Pupal period lasted for 9 - 11 days with an average of 10.25 ± 0.10 at 24.30 to 34.5°C and RH of 86%. Workers observed that pupal period of 7-8 days [13] and 8-18 days[14]. The pupa was measured 1.4 to 1.7 cm in length and 0.5 to 0.6 cm in width and pupal period was 7-8 days and in one of the studies the pupal period lasted for 11-12 days[15, 16]. The pupal viability was 81.6 ± 2.6 per cent [7].

Fig. 1: a) The insect cage for oviposition; b) hatched and unhacthed eggs; c) Eggs on shoot; d) Egg on opened flower; e) &f) Larva and entering into fruit respectively; g) pupae of anar butterfly, h) freshly emerged adult from pupae and i) Infested fruit with initial rotting near bored hole

Sexual dimorphism was observed in adults (Figure 2). Males are smaller in size than females in wing expansion. The male is glossy bluish violet (Figure 2b) while female is brownish violet having conspicuous orange patches on forewings (Figure 2a). Both sexes hind wing had 4-6mm long tail like structures on its anal margin. The body length of adult male was 23.02 ± 1.71mm and width including wing span was 43.89 ± 2.71mm, and longevity was 7-9 days with an averages duration of 8.26 ± 0.14 days (Table 1) whereas, body length of female butterfly was 25.04 ± 1.29mm with wing span of 47.15 ± 2.54 mm in width (Table 2) and longevity was 8-12 days with an average duration of 10.28 ± 0.20 days (Table 1) at 21.3-34.5 ^{0}C and 87% RH. The sex ratio of female to male was 1.75: 1 ± 0.10. Almost similar observations were made by [9]. When adults were fed with honey solution, the longevity of male and female was 6.1 and 11.2 days, respectively [10]. Adult longevity of Anar butterfly was ranged from 4-7 days with average 5.7 days [6]. Longevity of adults was 17-18 days at 25^{o}C and 75% relative humidity[16]. The average sex ratio of females to males was 1.80:1 ± 0.07 [7].

Fig. 2: Sexual dimorphism in Anar butterfly, *D. isocrates;* (a) female, (b) male

D. isocrates takes about 52-75 days with an averages duration of 63.92 days to complete life cycle from oviposition to adult emergence on pomegranate (Table 1). Total life cycle is completed within 30 to 60 days with average duration of 46.5 days[6].

Table 1. Developmental period and Adult longevity of Anar Butterfly on Pomegranate

	Duration (Days)	
Developmental stages	**Mean ± SE**	**Range**
Incubation period	7.15 ± 0.10	6 – 8
Larvar period		
I Instar	6.10 ± 0.15	5 – 8
II Instar	7.20 ± 0.26	6 – 8
III Instar	7.50 ± 0.32	6 – 9
IV Instar	6.20 ± 0.35	5 – 8
V Instar	5.90 ± 1.30	4 – 7
Pre-pupal period	4.35 ± 0.12	3 – 5
Pupal period	10.25 ± 0.10	9 – 11
Adult longevity		
Male	8.26 ± 0.14	7 – 9
Female	10.28 ± 0.20	8 – 12
Total life cycle	63.92 ± 2.87	52 – 75

Values are averages of 10 observations, SE= Standard Error.

Table 2. Morphometrics of life stages of Anar Butterfly on pomegranate

Particulars/Stages	Measurement (mm)			
	Length (Mean ± SE)	Range	Width (Mean ± SE)	Range
Egg			0.55 ± 0.30*	0.45 – 0.64
Larva				
I Instar	1.49 ± 0.21	1.25 – 1.85	0.86 ± 0.08	0.60 – 1.10
II Instar	6.59 ± 0.61	5.25 – 8.00	2.43 ± 0.49	1.56 – 3.34
III Instar	12.09 ± 2.23	10.50 – 15.25	3.82 ± 0.53	3.25 – 4.46
IV Instar	18.01 ± 1.26	16.00 – 20.50	5.12 ± 0.43	4.00 – 6.20
V Instar	21.07 ± 1.32	19.70 – 24.50	6.36 ± 0.54	5.65 – 7.30
Pre-Pupa	17.31 ± 1.73	15.25 – 20.00	7.22 ± 0.51	6.50 – 8.20
Pupa	14.25 ± 0.82	12.50 – 16.25	6.59 ± 0.91	5.00 – 7.50
Adult				
Female	25.04 ± 1.29	23.00 – 27.50	47.15 ± 2.54**	44.50 – 51.50
Male	23.02 ± 1.71	20.50 – 26.00	43.89 ± 2.71**	39.50 – 48.75

* Diameter, ** width with expanded wings, Values are averages of 10 observations, SE= Standard Error.

CONCLUSION

In the present investigation on bioecology of the insect pest is highly variable depending upon the weather parameters, host plant and habitat strategy of the pest under different cultivated ecosystems is difficult. Hence, location-specific studies on *D. isocrates* are necessary for evolving rational pest management strategies.

Acknowledgment

The authors are thankful to the Director, Indian Institute of Horticultural Research, Hessaraghatta Lake PO, Bengaluru, Karnataka, India for providing the facilities to carry out this study, and to Indian Council of Agricultural Research (ICAR), Krishi Anusandhan Bhavan-II, Pusa, New Delhi for financial support as a Junior Research Fellowship.

REFERENCES

1. Sajad Mohi-Ud-Din., Wani, N. A., Jamal Ahmad, M., Mir, G. M., and Sofi, M. A, "Seasonal Incidence of Anar Butterfly and It's Correlation with Weather Parameters". *The Bioscan*, **10(4):** 1561-1565 (2015).
2. Anonymous, "Area and Production of Pomegranate for Major Producing Districts, Horticultural Statistics at a Glance 2015". Horticulture Statistics Division, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare Government of India, Oxford University Press, New Delhi, India, pp 190& 237 (2015).
3. Mote, U. N., Ajri, D. S., and Tambe, A. B, "An annotated list of pests infesting pomegranate in Central Maharashtra". *Maharashtra Journal of Horticulture*, **6 (1):** 96-98 (1992).
4. Balikai, R. A., Kotikal, Y. K., and Prassana, P. M, "Status of pomegranate pests and their management strategies in India". *Acta Horticulturae*, **890:** 569-584 (2011).
5. Atwal, A. S, "Agricultural pests of India and South-East Asia". Kalyani Publishers, Ludhiana. pp 529, (1976).
6. Khan, M. M. H, Biology and Management of Fruit Borer, *Virachola isocrates* (Fab.) infesting Guava. *Bangladesh Journal of Agricultural Research,* **41(1):** 41-51 (2016).
7. Tiwari, A. K., Mishra, P. and Tiwari, S. C, "Biology of *Deudorix isocrates* Fabr. On Aonla, *Emblica officinalis". Annual Plant*

Protection Science, **15(2):** 335-337 (2007).

8. Butani, D. K, "Insect pests of fruit crops and their control, pomegranate". *Pesticides*, **10(6):** 23-26 (1976).
9. Monika Chhetry., Ruchie Gupta and Tara, J.S, "Bionomics of *Deudorix isocrates* Fab. (Lepidoptera: Lycaenidae), A New Potential Host of Sweet Orange, *Citrus sinensis* L. Osbeck in J&K, India". *International Journal of Science and Nature*, **6 (2):** 238-241 (2015)
10. Kabre, G.B. and Mohalkar, P.R, "Studies on life history of pomegranate fruit-borers, *Virachola isocrates* Fabr.". *Journal of Insect Science*, **5(2):** 213 (1992).
11. Srivatsava, O. S. and Jain, A. C, "Occurrence of *Virachola isocrates* Fab. (Lepidoptera:Lycaenidae) on *Emblica officinalis* (Amla or Aonla) in Madhya Pradesh". *Indian Journal of Entomology*, **35(1):** 352-353 (1973).
12. Shavale, B. S, Studies on life fecundity table of pomegranate butterfly. *Annual Plant Protection Science*, **11:** 253-257 (2003).
13. Karuppuchamy, P., Balasubramaniam, G. and Babu, P.C.S, "The biology of pomegranate fruit borer, *Deudorix isocrates"*. *The Madras Agricultural Journal*, **5(6):** 252-256 (1998).
14. Singh, S.B. and Singh, H.M, "Biology of *Deudorix isocrates* on its potential host-Aonla (*Emblica officinalis*)". *Indian Journal of Entomology*, **63(1):** 19-25 (2001).
15. Dharajyothi, B. and Tandon, P. L, "Pest management in sapota, pomegranate and ber". *Annual Report* 1992-93, IIHR, Hessarghatta, Bangalore, pp 26-31 (1993).
16. Abbas, S. R. and Sharma, S, "Bio-ecology and population dynamics of insect pests of mango (Fruitfly and Leaf Webber) and guava (Fruit borer)". *Annual Report* 1993-94, Central Institute of Horticulture for Northern Plains, Lucknow, pp 20-25 (1994).