

Study of fruit-borer *Deudorix (Virachola) isocrates* on pomegranate (*Punica granatum*) and its fluctuation through abiotic stress

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ABSTRACT

The experiment was conducted to study the relation between the occurrence of mature and immature stages of *Deudorix isocrates* (Lepidoptera: Lycaenidae), on pomegranate (*Punica granatum* L.) plant phenology, and changes in population due to abiotic stress at College of Horticulture & Forestry, Jhalawar, during 2022–23. The population dynamics of *Deudorix isocrates* larvae on fruits was monitored during the *kharif* seasons of 2022 and 2023, under different climatic factors, such as mean temperature (°C), relative humidity (%), and rainfall (mm). The data showed that pomegranate fruit was most preferential host plant for fruits borer, serving as the prime host plant when other potential host plants were not available during certain developmental stages of the pest. The pest population reached to peak during 36th standard meteorological week (SMW) during both years. Statistical analysis indicates a positive, but non-significant, correlation with temp ($x_1 = 0.32$) and negative, non-significant correlations with relative humidity ($x_2 = -0.47$) and rainfall ($x_3 = -0.35$) during 2022. In contrast, during 2023, pest exhibited a negative, non-significant correlation with temperature ($x_1 = -0.23$), and positive, non-significant correlations with both relative humidity ($x_2 = 0.31$) and rainfall ($x_3 = 0.36$)

Key words: Abiotic stress, *Deudorix (Virachola) isocrates* Host plant, Fruit, borer

Pomegranate (*Punica granatum* L.) is a prominent fruit crop in India. Its cultivation is significantly affected by a diverse range of insect pests, lepidopteran species being most damaging ones. These pests severely impact fruit quality and marketability (Abd-Ella, 2015). In India alone, over 50 species of insect pests have been reported infesting pomegranate (Butani, 1979; Balikai, 2000). Among these, the most damaging is fruits-borer butterfly, *Deudorix (Virachola) isocrates* Fabricius, which can cause damage on more than 50% of developing fruits (Balikai *et al.*, 2011). The early larval stage of *V. isocrates* bores into fruits, feeding on seeds and the pulp. The entry holes created by its larvae also serve as an infection site for other pathogens, resulting in extensive fruit rotting (Balikai *et al.*, 2009; Abazaid *et al.*, 2021). Having a wide host preference, *V. isocrates* is considered to as the most destructive pest of pomegranate, causing 65–70% yield loss globally (Gupta and Dubey, 2005; Kumar, 2010; Kumar *et al.*, 2017). Therefore, to understand the phenological stages of pomegranate in regard to pest infestation was studies.

MATERIALS AND METHODS

Field trials were conducted at College of Horticulture and Forestry, Jhalawar, during *kharif* seasons of 2022 and 2023 to assess the seasonal occurrence and population dynamics of insect pests associated with pomegranate fruit, with a specific focus on fruits-borer *Deudorix (Virachola) isocrates* in Bhagwa variety of pomegranate.

Fruit borer population were documented at weekly intervals during fruiting season. For sampling, five distinct sites within the orchard, representing cardinal directions (North, South, East, West, and Centre), were selected. From each site, five plants were randomly chosen each week to assess the number of healthy and infested fruits. Infestation was identified by the presence of active bore holes in fruits, which indicated larval activity. The population of fruit-borer larvae was studied based on visible symptoms. Meteorological data, including ambient temperature (°C), relative humidity (RH%), and rainfall (mm), were also collected to analyse their relationship with pest occurrence. Coefficient of correlation was employed to determine the statistical relationship between environmental parameters and pest population dynamics.

RESULTS AND DISCUSSION

The early appearance of fruit-borer was observed during second week of August (32nd Standard Meteorological Week [SMW]) with a mean larval population of 1.00 and 1.50 larvae/ five fruits during 2022 and 2023, respectively (Tables 1 and 2). The pest population subsequently increased, reaching its peak during first week of September (36th SMW), with a maximum mean population of 6.50 and 7.50 larvae/ five fruits during 2022 and 2023, respectively. Following this peak, the population began to decline, with a notable reduction documented by fourth week of September (39th SMW), and complete disappearance by the second week of October during both years.

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Table 1: Influence of abiotic factors on seasonal incidence of pomegranate fruit-borer during *kharif* 2022

Standard Meteorological Weeks (SMW)	Date of Observation	Abiotic factor			Fruit borer (per 5 fruits)
		Mean Temp. (°C) (X_1)	Mean R.H. (%) (X_2)	Total Rainfall (mm) (X_3)	
31	30 July -5Aug	26.05	73.2	24	00
32	6 Aug-12 Aug	27.05	78.65	49	1.5
33	13 Aug-19 Aug	25.2	81.75	116	3.9
34	20 Aug-26 Aug	25.75	88.35	263	2.6
35	27 Aug-2 Sept	28.45	59.35	2	3.6
36	3 Sept -9 Sept	27.95	67.7	20	6.6
37	10 Sept-16 Sept	27.2	75.95	73	3.5
38	17 Sept - 23 Sept	26.2	74.4	42	1.6
39	24 Sep – 30 Sep	26.05	60.45	0	1.00
Seasonal mean		26.66	73.31	589.00	3.04
Coefficient of correlation (r) for population and mean atm. temperature					0.32
Coefficient of correlation (r) for population and mean relative humidity					-0.47
Coefficient of correlation (r) for population and total rainfall					-0.35

Table 2: Influence of abiotic factors on seasonal incidence of pomegranate fruit-borer during *kharif* 2023

Standard Meteorological Weeks (SMW)	Date of observation	Abiotic factor			Fruit-borer (per 5 fruits)
		Mean temp. (°C) (X_1)	Mean R.H. (%) (X_2)	Total rainfall (mm) (X_3)	
31	30 July -5Aug	27.5	89.0	13.0	00
32	6 Aug-12 Aug	27.5	78.0	3.0	1
33	13 Aug-19 Aug	27.5	86.0	7.0	1.9
34	20 Aug-26 Aug	28.0	90.5	126.0	3.6
35	27 Aug-2 Sept	28.0	85.5	0.0	5.6
36	3 Sept -9 Sept	27.5	77.0	43.0	7.5
37	10 Sept-16 Sept	28.0	93.0	134.0	4.9
38	17 Sept - 23 Sept	28.5	81.5	14.0	2.3
39	24 Sep – 30 Sep	28.50	60.00	0.0	1.50
Seasonal Mean		27.81	85.06	340.00	3.54
Coefficient of correlation (r) for population and mean atm. temperature					-0.23
Coefficient of correlation (r) for population and mean relative humidity					0.31
Coefficient of correlation (r) for population and total rainfall					0.36

The fruits-borer infestation was more severe in 2023 than in 2022. This hike may be due to higher mean relative humidity, slightly elevated atmospheric temperature, and lower cumulative rainfall during the critical infestation period in 2023. Specifically, during the peak infestation period, the average temperature, relative humidity, and rainfall were 27.55°C, 67.7%, and 20.0 mm during 2022, compared to 27.50°C, 77.0%, and 43.0 mm during 2023. The pest showed positive non-significant correlation with temperature ($x_1 = 0.32$) and negative non-significant correlation with humidity ($x_2 = -0.47$) and rainfall ($x_3 = -0.35$) during 2022. In 2023 the pest showed negative non-significant correlation with temperature ($x_1 = -0.23$) and positive non-significant correlation with humidity ($x_2 = 0.31$) and rainfall ($x_3 = 0.36$).

These findings bring into line with those of Haseeb and Sharma (2007). Similarly, Kumari *et al.* (2011) observed maximum infestation during third week of August. However, local variations have also been noted. These regional discrepancies may be due to differences in fruiting phenology and local climatic conditions, as also suggested by Shevale and Khaire (1999). Regarding larval load per fruit, Uma Shankar *et al.* (2007) documented an average of 6.75 caterpillars/ fruit, while Balikai *et al.* (2011) observed up to 8 caterpillars in a single fruit. In contrast, Singh (1973) recorded a maximum of 4 larvae/ fruit.

CONCLUSION

The study confirmed that fruits-borer, *Deudorix* (*Virachola*) *isocrates* was most persistent and destructive

insect pest affecting pomegranate during both *khariif* seasons of 2022 and 2023. The initial emergence of larvae was observed during the second week of August (32nd Standard Meteorological Week [SMW]) in both years. Peak infestation levels were recorded during first week of September (36th SMW), indicating a consistent seasonal pattern of occurrence. Despite comprehensive monitoring and correlation analysis, no statistically significant relationship was observed between fruits borer population and weather parameters (temperature, relative humidity, and rainfall) during the study.

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