



Observations on feeding and reproductive habits of *Deudorix isocrates* (FAB), (Lepidoptera: Lycinidae)

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Abstract

Deudorix isocrates is one of the serious pests of Pomegranate, *Punica granatum*. The present study was undertaken to study its feeding and reproductive habits since understanding of biological habits of pest is helpful to find control measures against the pest. As per laboratory rearing method, the fecundity rate of an individual female was ranged from 07 to 142 (average 60.19) eggs. The oviposition period was found 01 to 33 days with average 9.8 days during *Mrig bahar* (June-Sept.). It was found that rarely the gravid female deposits the egg on flower, twigs and underside of leaves. The calyx end of fruit is the most preferred site of egg laying (68.65%) than other parts like lower half (11.56%), stalk base (8.31%), upper half (7.49%) and middle region (3.97%) of the fruit. After hatching the most of the neonate larvae (32%) consumed 16 to 30 minutes to start cutting the fruit rind for their entry into the fruit by making a minute entrance hole. After getting entry into the fruit the larva feeds on seeds and pulp of the pomegranate fruit throughout larval phase. It drops the excretory pellets outside the fruit through entrance hole. These observations on egg laying habits and feeding habits suggest the mechanical measures like paper bagging of the fruits to minimize the pest attack.

Keywords: *Deudorix isocrates*, fecundity, feeding habit, pomegranate, pest

Introduction

The members of Lepidoptera including moths and butterflies are reported as the agricultural pests with large number. Due to considerable yield loss caused by them they have been reported as commercially important pests, *Deudorix isocrates* is one of them. It attack wide range of host plants like guava, aonla, ber, citrus, tamarind, apple, sapota apart from the pomegranate (Singh and Singh, 2009; Balikai *et al.*, 2011; Chhetry *et al.*, 2015; Arya and Dubey, 2017; Gundappa *et al.*, 2017; Muthiah and Indragandhi, 2021) [23, 2, 8, 1, 9, 16]. However, it appeared as the most destructive pest of Pomegranate, *Punica granatum* (Gupta and Dubey, 2005, Kumar, 2010) [10, 12] causing 65-70% yield loss worldwide (Kumar *et al.*, 2017) [13]. It is distributed all over India and common in Maharashtra (Ritesh kumar, 2020) [20]. In India it causes 40-90% yield loss of pomegranate (Wadhi and Batra, 1969; Nair, 1978) [24, 17], consequently results in to remarkable economic loss of the pomegranate growers. In Maharashtra and Karnataka, the incidence of *D. isocrates* on pomegranate has been reported throughout the year with varying degrees of intensity (Shevale and Khaire, 1999) [22]. The considerable research work has been carried out on bionomics, pest incidences on various host plants, population dynamics, and management of *D. isocrates*. But the work on pest habits is not considerably reported earlier. The biological understanding of the pest habits has a greater significance to understand adaptive features in lepidopteran pests and their host plant specificity (Chardonnet *et al.*, 2014) [7]. Understanding of adaptive habits of the pests is important in pest management (Paula *et al.*, 2012; Pannuti, 2019) [19, 18]. The present study was carried out with the same view to predict some measures against the pest attack of *D. isocrates* on the basis of its feeding and reproductive habits.

Materials and Methods

The present work was carried out through field survey, collection of biological material and laboratory rearing. The pomegranate fields were selected nearby Baramati town (MS), the part of district Pune of the state Maharashtra.

The reproductive habits with respect to egg laying sites and fecundity was studied by field survey. During the survey sites of egg laying were noted. Total 1107 observations were recorded and analyzed in the form of specific region of the fruit and the number of eggs deposited on it. To study fecundity rate the pairs of male and female were reared separately after their eclosion in a separate plastic jars to mate and deposit the eggs under laboratory conditions. Every day the fresh fruit was kept to deposit egg. The observations were recorded for the oviposition period and the eggs laid during this period. To understand feeding habit of the first instar larva, the time of hatching was noted. The newly hatched larva was gently lifted by camel hairbrush and placed on the fresh pomegranate fruit so as to allow it to enter into the fruit. Separate fresh fruit was provided for each larva and observed critically till it started boring the fruit rind. The period between hatching and commencement of

boring the rind was referred to as searching period. Total 50 observations were recorded for further analysis. The feeding habits during the later instar stages were recorded by conducting field survey.

Results

As per laboratory rearing method, the fecundity of an individual female ranged from 07 to 142 (average 60.19). The oviposition period was found 01 to 33 days with average 9.8 days during *Mrig bahar* (June-Sept.). While depositing the eggs the female searches suitable site on the fruit for egg laying. The studies revealed inside the fruit calyx is the most preferred site (68.65%) of egg laying while middle region of fruit was mostly rejected (3.9%) to deposit the egg. However, stalk base (8.31%), upper half (7.49%) and lower half (11.56%) of fruit were also the sites of egg laying reported during the studies. These results suggested that the preferable egg laying site is inside of the calyx; while the least preferable site is the middle region of the fruit.

After hatching larvae spent varying time period in crawling on the fruit surface to search entry site on fruit rind. It is referred here as searching period. The searching period was reported from less than 15 minutes up to more than 4hrs. but maximum number (32%) of larvae spent 16 to 30 minutes to start cutting of fruit rind.

In present study it was observed that at the beginning newly hatched larva entered the rind of fruit by continuous chewing and cutting the rind till it entered in the fruit completely. The larva made a narrow tunnel always heading towards inside of the fruit. In later days of instar to instar, the larva turned and heading outwards it cut the rind time to time. This activity resulted into gradual increase in size of the entrance hole. According to present investigation the average size of entrance hole was found 0.84 mm in first instar, 1.43 mm in second instar, 2.68 mm in third instar and 5.76 mm in fourth instar stage of larva.

Discussion

D. isocrates female lays eggs singly, some times in a pair and rarely in the small clutch on flowers, leaves and young fruit surface including calyx cup. This general egg laying habits have been reported by earlier workers (Balikai *et al.*, 2011; Bhut *et al.*, 2013; Kumar *et al.*, 2017; Bharti *et al.*, 2021; Kaushal *et al.*, 2021) [2, 6, 13, 5, 11] also. In present investigation it was found that leaves and flowers were rarely preferred for oviposition and mostly the fruits of varying stages were used to deposit eggs. The calyx end of fruit is the highly preferred site of egg laying than other parts like lower half, stalk base, upper half and middle region of the fruit. The similar egg laying habit of the female *D. isocrates* has been reported earlier (Shevale, 1997) [21] by comparing egg laying from different portions of fruit surface including calyx end. An appropriate site of egg laying is the part of parental care (Mani, 1971) [14]. Deposition of eggs on the most protected site is a strategy for escaping egg predation (Baguette and Schtickzelle, 2003) [4]. Accordingly in case of *D. isocrates* "appropriate" site of egg laying is found to be inside of the calyx where the eggs get protected from predation as a parental care. This finding is helpful to monitor pest attack during early stage at egg laying before fruit damage caused by early instar larva. The results also suggest paper bagging of fruits as a preventive measure against the pest attack through which we can avoid egg laying on the fruits. The paper bagging against this infestation is recommended by earlier work (Kumar and Kamala Jayanthi, 2018; Riteshkumar, 2020) [20] so as to minimize pest attack. In case of *D. isocrates* this control method reduces pest attack up to 10% against 90% in open fruits (Bagle, 2011) [3].

After hatching the 1st instar larva spent some time on fruit surface (Kaushal *et al.*, 2021) [11] to find suitable site to enter into the fruit. During which the larva crawls on the fruit rind. On getting suitable site of entry, it cuts the rind (Kumar *et al.*, 2017) [13] with its mandibular mouth parts and makes a fine hole; the entrance hole. The larva continues to cut the fruit rind till it reaches inside the fruit. The present study revealed that the maximum number of larvae (32%) consumed 16 to 30 minutes to start cutting the fruit rind.

After getting entry into the fruit the larva starts to feed on seeds and pulp of the pomegranate fruit. It remains concealed in the fruit and never seen came out from the fruit during day time. It pushes its abdomen back and drops the excretory pellets outside the fruit. This feeding habit indicates that the larva during its life tries to keep the fruit interior clean for feeding on pulp and seeds by dropping the excreta outside the fruit. To drop excreta outside the fruit, it increases the diameter of entrance hole in accordance with increasing body size during larval growth from first instar to last instar. The increase in diameter was recorded from 0.84 mm (first instar stage) to 5.76 mm (last instar stage). This habit of *D. isocrates* has been reported in earlier work with some variations in dimensions of entrance hole (Shevale, 1997) [21]. It supports observations of present study.

Conclusion

The present observation-based work on reproductive and feeding habits of *D. isocrates* revealed egg laying adaptation to prefer the calyx cup to protect their eggs. For the feeding, the larva damages fruit by making entrance hole. Such type of damage causes the considerable yield loss. These observations suggest paper bagging of the fruits to minimize pest attack.

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