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Seasonal occurrence of the fruit borer (*Virachola Isocrates*) on pomegranate (*Punica granatum*) and its relationship to abiotic factors

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Abstract
The investigation was carried out in the Dry Land Horticulture Research Farm, Pt. Shiv Kumar Shastri College of Agriculture & Research Station, Surgi, district Rajnandgaon, during the kharif-rabi season of 2020-21. Twenty-four insect pests were identified causing damage to pomegranate at various growth stages in pest succession studies. Among them fruit borer *i.e.* anar butterfly was recorded as major insect pests of pomegranate and study of fruit borer, *D. Isocrates* was made in details. The first appearance of fruit borer, *D. Isocrates* larvae was observed during first week of August (31st SMW) with 5.50 larvae/5 fruits, which was the maximum population of pomegranate fruit borer during the period of study. A significant negative relationship was found between fruit borer, *D. Isocrates* population and minimum temperature with the correlation coefficient values (r) of -0.372. Coefficient of multiple regression R^2 was non-significant with all-weather parameters except morning relative humidity. The selected weather parameter explained 0.500 per cent variation in the activity of fruit borer population. Studies on level of infestation of fruit borer, *D. Isocrates* at fruiting stage of pomegranate revealed that maximum fruit borer infestation were recorded during the month of August with 6.93 per cent fruit borer infestation. In the view of bahar system in pomegranate, maximum average fruit borer, *D. Isocrates* infestation were recorded in *ambe bahar* cropping season with and 4.33 per cent fruit borer infestation followed by *hasta bahar* and *mrig bahar* seasons with 3.73 and 3.00 per cent fruit borer infestation, respectively.

Keywords: Pomegranate, anar, *Punica granatum*, fruit borer, anar butterfly, *Virachola Isocrates*, *Deudorix* Isocrates, environmental factor

Introduction
The pomegranate (*Punica* granatum L.) is a popular fruit crop in India. Pomegranate is a big shrub or small tree with evergreen, silky leaves and brilliant orange to re d blooms. It bears a special fruit with a dry exterior covering composed of two layers: A hard outer layer known as an epicarp and a soft interior layer known as a mesocarp. Pomegranate farming is widely practiced in Mediterranean nations like Spain, Morocco, Egypt, Iran, Afghanistan, and Baluchistan. It was first domesticated in Iran. In some capacity, it is grown in Myanmar, China, the United States, and India. According to Balikai *et al.* (2011) [18], India is the world leader in pomegranate farming. India has the perfect environment for cultivating a variety of fruits because to its diversified soil and temperature. A total of 50 million tonnes of fruit are produced annually on an area of around 3.94 million hectares. The Indian Council of Medical Research (ICMR) recommends 85g of fruit per head per day, while only 55 g of fruit is available per head per day in India. Pomegranates are high in fibre, packed with vitamins and minerals, and low in calories and fat. Antioxidants, heart health, urinary health, endurance while exercise and more advantages are included. The nutritional profile of pomegranates is outstanding. 7 grams of fibre, 3 grams of protein, 30% of the recommended daily intake of vitamin C, 36% of the recommended daily intake of vitamin K, 16% of the recommended daily intake of folate, and 12% of the recommended daily intake of potassium are all found in one cup of arils (174 grams) (Anonymous, 2018). Pomegranates are red fruits that are spherical in shape. They have a white interior flesh that is densely packed with crisp, juicy edible seeds known as arils. They may be best known for the vibrantly coloured juice in which they are frequently employed, but these unusual fruits have much more to offer.

Pomegranate, like other crops, is vulnerable to assault by a variety of insect pests. As many as 50 different insect pest species have been documented on pomegranate from diverse locations of India. Pomegranate trees are attacked by around 45 insect species (Butani, 1979) [19], 32 insect and non-insect pests (Balikai, 2000) [7], 2 more than 50 insect species, and 33 insect pests. The most vexing foe of the pomegranate tree is the butterfly, *Virachola Isocrates* Fab. This has the potential to damage more than half of the fruits (Balikai *et al*., 2011) [18].

Materials and Methods

Field trials were carried out at the Dry Land Horticulture Research Farm, Pt. SKS College of Agriculture & Research Station, Surgi, Rajnandgaon, during the kharif rabi of 2021-22. To determine the seasonal occurrence of insect pests linked with the pomegranate crop, fruit borer populations were collected at weekly intervals on the *Bhagwa* variety of pomegranate. Five plants were chosen at random each week to count the damaged and healthy fruits for this reason. During fruiting season, an active hole on a fruit caused a weekly population of fruit borer larvae to be recorded. The seasonal incidence of key insect pests was associated with meteorological conditions. Correlations were used to determine the association between weather conditions and significant insect infestations. For calculating the data by subjecting to the correlation between weather parameters and insect population were determined by using Karl Pearson's coefficient of correlation formula:

$$r = \frac{\sum XY - \frac{(\sum X)(\sum Y)}{n}}{\sqrt{\sum X^2 - \frac{(\sum X)^2}{n}}\sqrt{\sum Y^2 - \frac{(\sum Y)^2}{n}}}$$

Where, r = Simple correlation coefficient X = Variable i.e. abiotic component (Temperature, relative humidity, rainfall and sunshine) Y = Variable i.e. mean number of insect pests/shoot N = Number of observations. The correlation (r) values were subjected to the test of significance using critical value of the correlation coefficient.

During the pomegranate fruiting season, the incidence of fruit borer was observed at weekly intervals. Ten plants were chosen at random and tagged to count the quantity of damaged and healthy fruits on each plant. Later, the percent fruit damage was worked out as follow:

$$\text{Percent infestation} = \frac{\text{number of damaged fruits}}{\text{total number of fruits}} \times 100$$

Result and Discussion

Seasonal incidence of fruit borer; *Deudorix Isocrates* infesting pomegranate crop during *kharif-rabi*, 2021-22 is presented in Table 1.1. Fruit borer, *Deudorix* sp**.** is one of the most prevalent insect pest of pomegranate. Its first occurrence on fruiting stage of the crop was observed during the first week of August (31st SMW) with a mean population of 5.50 larvae/5 fruits as a peak of fruit borer population. Thereafter, the population of pomegranate fruit borer gradually declined and reached up to 1.00 larva/5 fruits during the third week of September (37th SMW). After that, the population was completely disappeared from the fourth week of September (38th SMW) to fourth week of October (43rd SMW). During the next fruiting season (*Mrig bahar*) the activity of fruit borer insect was started from first week of November (44th SMW) with the population of 0.80 larva/5 fruits. After that, the population was gradually increased and reached to maximum peak of 5.20 larvae/5 fruits during the fourth week of January (4th SMW) and steadily at the same population during the first week of February (5th SMW) and third week of February (7th SMW) which were the successive peaks of the *Deudorix Isocrates* population during *Mrig bahar* with the seasonal mean population of 2.76 larvae/5 fruits. In present investigation, maximum population of fruit borer was recorded during first week of August which is in agreement with the finding of Desai *et al.* (2018) [20] who reported that the incidence of *Deudorix Isocrates* on pomegranate crop was maximum during monsoon season with peak activity of 5.00 larvae/tree during the month of August. Murugan and Thirumurugan (2001) [21] reported that severe infestation of fruit borer started from March onwards in pomegranate and reached to its peak in July –August and diminished during October which is in accordance with the present investigation.

The effect of meteorological conditions on the seasonal variability of the pomegranate fruit borer population

The first appearance of the fruit borer was detected in the first week of August, with 5.50 larvae/5 fruits, and was associated with maximum and minimum temperatures of 33.28 ºC and 25.86 ºC, respectively, and morning and evening relative humidity of 85.14 and 65.86 percent, respectively, with 2.80 mm of rainfall. Fruit borer populations gradually dropped and vanished between the third and fourth weeks of September. Following that, the fruit borer population gradually increased with slight fluctuations, reaching a peak population of 5.20 larvae/5 fruits during the 4th, 5th, and 7th SMW, which was associated with average maximum and minimum temperatures of 27.14 ºC and 11.71 ºC, respectively, and average morning and evening relative humidity of 86.33 and 23.66 percent with average rainfall of 0.14 mm. According to a correlation analysis, fruit borer was significantly adversely connected with minimum temperature, with a correlation coefficient value of r = -0.372. The findings of Sekha *et al*. (2020) in India demonstrated that maximum and lowest temperature had a negative and substantial link with the population of *D. Isocrates*, which is consistent with the current study.

Regression equation for minimum temperature was – y = 4.864 – 0.113x (R^2 = 0.139)

Where, x = minimum temperature (ºC)

The above equation revealed that every unit increase in minimum temperature, the fruit borer population decreased by 0.113.

The resultant multiple regression equation was derived and expressed as

$Y = 27.551 – 0.177\ X_1 – 0.148\ X_2 + 0.048\ X_3 – 0.165^*\ X_4 – 0.003\ X_5 - 0.371\ X_6$

(R^2 = 0.500)

The above equation indicated that coefficient of multiple regression R^2 was non-significant with all-weather parameters except morning relative humidity.

According to the current research, average maximum and minimum temperatures of 27.14 ºC and 11.71 ºC, respectively, and average morning and evening relative humidity of 86.33 and 23.66 percent, were shown to be conducive to the multiplication of fruit borer populations on pomegranate.

Table 1.1: Weekly population of pomegranate fruit borer during kharif-rabi 2021-22 at Surgi, Rajnandgaon

SMW	Date of observation	Fruit borer (larvae per 5 fruits)
31	05-08-2021	**5.50**
32	12-08-2021	5.00
33	19-08-2021	4.60
34	26-08-2021	3.30
35	02-09-2021	2.60
36	09-09-2021	2.10
37	16-09-2021	1.00
38	23-09-2021	0.00
39	30-09-2021	0.00
40	07-10-2021	0.00
41	14-10-2021	0.00
42	21-10-2021	0.00
43	28-10-2021	0.00
44	03-11-2021	0.80
45	11-11-2021	1.20
46	18-11-2021	1.40
47	25-11-2021	1.80
48	02-12-2021	2.00
49	09-12-2021	2.20
50	16-12-2021	2.60
51	23-12-2021	3.90
52	31-12-2021	2.80
1	07-01-2022	3.30
2	13-01-2022	3.60
3	21-01-2022	4.30
4	28-01-2022	5.20
5	04-02-2022	5.20
6	11-02-2022	4.10
7	18-02-2022	5.20
8	25-02-2022	3.90
9	04-03-2022	3.60
10	11-03-2022	3.80
11	17-03-2022	3.60
12	25-03-2022	4.10
13	31-03-2022	3.80
Seasonal mean		2.76

Table 1.2: Effect of meteorological conditions on seasonal variation of pomegranate fruit borer population during kharif-Rabi 2021-22 in Surgi, Rajnandgaon

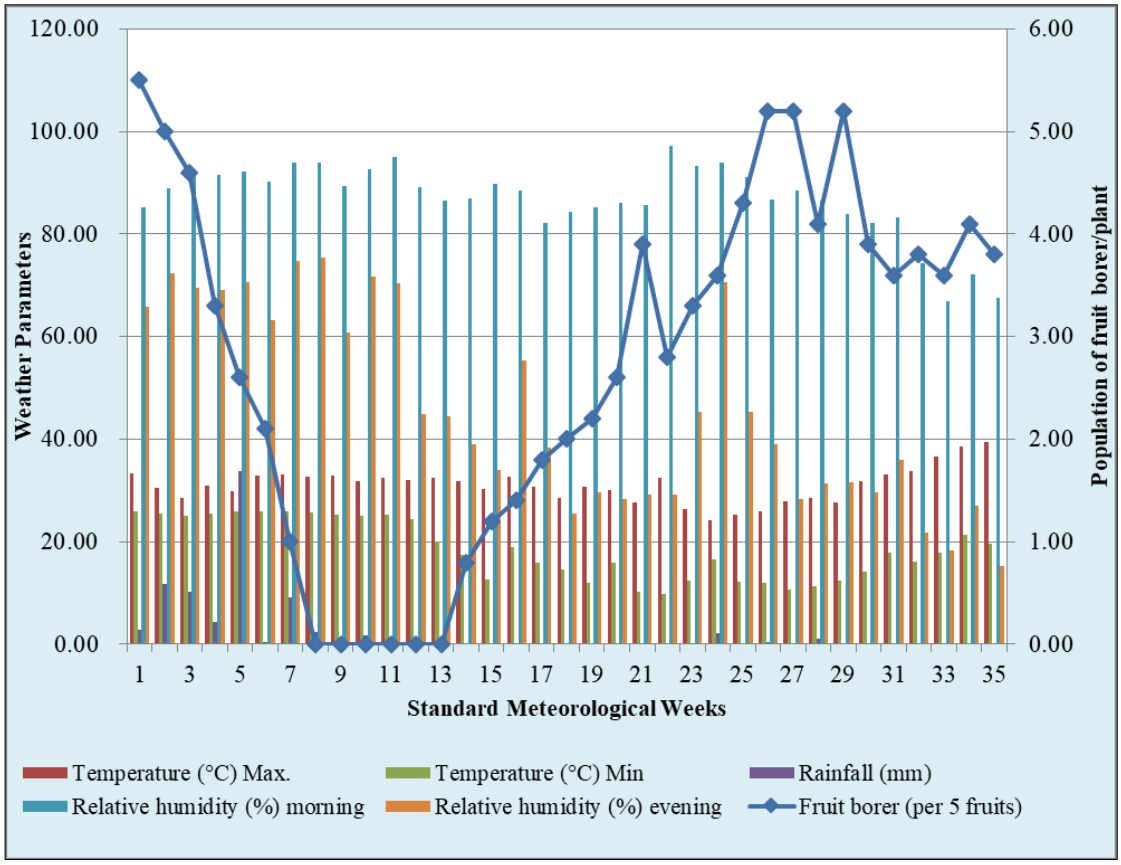
SMW	Date of observation	Temperature (ºC)		Rainfall	Relative Humidity (%)		Sunshine	Fruit borer (per 5 fruits)
		Maximum	Minimum		morning	evening		
31	05-08-2021	33.28	25.86	2.80	85.14	65.86	5.53	5.50
32	12-08-2021	30.48	25.46	11.68	89.00	72.28	1.84	5.00
33	19-08-2021	28.44	25.13	10.17	91.86	69.43	2.41	4.60
34	26-08-2021	31.00	25.46	4.26	91.43	69.14	5.46	3.30
35	02-09-2021	29.76	25.90	33.68	92.14	70.57	4.02	2.60
36	09-09-2021	32.88	25.95	0.43	90.14	63.28	6.53	2.10
37	16-09-2021	33.17	25.97	9.14	94.00	74.71	3.84	1.00
38	23-09-2021	32.68	25.77	2.34	94.00	75.43	3.50	0.00
39	30-09-2021	32.80	25.26	0.00	89.28	60.71	7.48	0.00
40	07-10-2021	31.80	24.96	1.83	92.71	71.80	5.20	0.00
41	14-10-2021	32.53	25.26	0.00	95.00	70.43	4.84	0.00
42	21-10-2021	31.94	24.41	1.00	89.14	44.86	7.66	0.00
43	28-10-2021	32.56	20.11	0.00	86.43	44.43	7.93	0.00
44	03-11-2021	31.80	17.43	0.00	86.86	39.00	7.80	0.80
45	11-11-2021	30.31	12.53	0.00	89.71	34.00	9.03	1.20
46	18-11-2021	32.67	18.93	0.00	88.43	55.43	5.17	1.40
47	25-11-2021	30.67	15.90	0.05	82.14	38.28	6.93	1.80
48	02-12-2021	28.60	14.66	0.00	84.43	25.57	8.78	2.00
49	09-12-2021	30.67	11.88	0.00	85.28	29.71	8.44	2.20
50	16-12-2021	30.16	15.80	0.00	86.14	28.28	8.48	2.60

51	23-12-2021	27.66	10.27	0.00	85.71	29.14	7.83	3.90
52	31-12-2021	32.47	9.88	0.00	97.28	29.14	9.93	2.80
1	07-01-2022	26.33	12.44	0.00	93.28	45.43	6.87	3.30
2	13-01-2022	24.28	16.60	2.14	94.00	70.57	2.84	3.60
3	21-01-2022	25.34	12.20	0.00	91.00	45.43	6.07	4.30
4	28-01-2022	25.97	12.07	0.43	86.71	39.00	6.74	5.20
5	04-02-2022	27.81	10.74	0.00	88.43	28.43	8.86	5.20
6	11-02-2022	28.47	11.36	1.00	86.57	31.43	7.47	4.10
7	18-02-2022	27.64	12.34	0.00	83.86	31.57	7.30	5.20
8	25-02-2022	31.89	14.21	0.00	82.14	29.71	6.33	3.90
9	04-03-2022	33.08	17.88	0.00	83.28	35.86	6.16	3.60
10	11-03-2022	33.81	16.10	0.00	74.28	21.86	8.53	3.80
11	17-03-2022	36.53	17.94	0.00	67.00	18.28	8.71	3.60
12	25-03-2022	38.50	21.46	0.00	72.14	27.00	7.94	4.10
13	31-03-2022	39.52	19.53	0.00	67.50	15.17	6.57	3.80
Overall seasonal mean								2.76

Table 1.3: Correlation coefficient (r) of different weather parameters on fruit borer of pomegranat

Weather parameter	Correlation coefficient (r)
Maximum Temperature (ºC)	-0.234
Minimum Temperature (ºC)	-0.373
Rainfall	0.062
Morning Relative Humidity (%)	-0.325
Evening Relative Humidity (%)	-0.297
Sunshine hours (lux)	-0.037

*Significant at 5%, **Significant at 1%



Anar butterfly, Deudorix sp.

Fruit borer larvae

Damage symptoms on fruit caused by fruit borer

Fig 1.1: Effect of meteorological conditions on pomegranate fruit borer seasonal activity

Conclusion

The study concluded that the fruit borer, anar butter fly During kharif-rabi 2021-22, *Deudorix Isocrates* was the most irritating and destructive insect pest of pomegranate. The initial emergence of fruit borer larvae was noticed during the first week of August (31st SMW), with 5.50 larvae/5 fruits, which represented the highest population of pomegranate fruit borer during the study period. In addition, fruit borer activity was recorded during the fourth week of January (4th SMW), the first and third weeks of February (5th and 7th SMW), with a population of 5.20 larvae/5 fruits in each and a seasonal mean of 2.76 larvae/5 fruits. The first appearance of fruit borer was observed in the first week of August with 5.50 larvae/5 fruits, which was the peak activity of fruit borer linked with the maximum and minimum temperature of 33.280C and 25.860C, respectively, and morning and evening relative humidity of 85.14 and 65.86%, respectively, with 2.80mm rainfall. Deudorix Isocrates, a fruit borer, was found to be significantly negatively linked with minimum temperature, with a correlation coefficient of -0.372. With the exception of morning relative humidity, the coefficient of multiple regression R2 was non-significant for all weather parameters. The selected weather parameter explained 0.500% of the variation in fruit borer population activity.

Among the major insect pests of pomegranate crop, the effects of ambient weather parameters were also observed. Fruit borer was found significantly negatively correlated with minimum temperature.

References

1. Amal MF, Al-Barty. Survey and enumeration of pests on pomegranate tree with reference to its parasite in Al-Taif City. Australia Journal Basic Applied Science. 2011;5:1086-1093.
2. Anonymous. Annual Report of 1998-99, Indian Institute of Horticultural Research, Bangalore-560089, India; c2000.
3. Anonymous. Area, production and productivity of pomegranate in India, Indiastat.com; c2016-17.
4. Anonymous. Exports from India pomegranates fresh; c2019. Retrieved from: https://www.agriexchange.apeda.gov.in
5. Anonymous. 2019. Horticultural statistics at a glance; c2017. Retrieved from http://nhb.gov.in.
6. Bagle S. Studies on varietal reaction, extent of damage and management of ANAR butterfly, *Deudorix* (=*Virachola*) *Isocrates* Fab, in pomegranate. Acta Horticulturae. 2009;890:557-560.
7. Balikai, RA. Status of pomegranate pests in Karnataka. Pest Management Horticultural Ecosystem; 2000;6(1):65-66.
8. Balikai RA, Kotikal YK, Prasanna PM. Status of pomegranate pests and their management strategies in India. IInd International Symposium on Pomegranate and Minor including Mediterranean-Fruits: ISPMMF; c2009.
9. Bhakare M. *Deudorix Isocrates* Fabricius 1793 – Common Guava Blue. In Kunte P, Roy P, Kalesh S, Kodandaramaiah U. (eds.) Butterflies of India, v.2.20. Indian Foundation for Butterflies; c2015. http://www.ifoundbutterflies.org/sp/635/Virachola-Isocrates.
10. Dongarjal RP. Seasonal incidence and management of major insect pests of pomegranate. Ph.D. (Agri.) Thesis, VNMKV, Parbhani; c2017.

11. Kahramanoglu I, Usanmaz S. Management strategies of fruit damaging pests of pomegranate *Planococcus citri*, *Ceratitis capitata* and *Deudorix* (*Virachola*) *livia*. African Journal of Agricultural Research, 2013;8:6563-6568.
12. Kakar KL, Dogra, CS, Nath A. Incidence and control of pomegranate fruit borer, *Virachola Isocrates* (Fabricius.) and *Deudorix epijarbas* (Moore). Indian Journal of Agricultural Sciences, 1987;57:749-752.
13. Karuppuchamy P. Studies on the management of pests of pomegranate with special reference to fruit borer, *Virachola Isocrates* (Fab.). Ph.D. Thesis, Tamil Nadu Agril. Univ., Coimbatore (India); c1994.
14. Ksentini I, Jardak T, Zeghal N. First record on *Virachola livia* Klug. (Lepidoptera: Lycaenidae) and its effects on different pomegranate varieties in Tunisia. EPPO Bulletin. 2011;41:178-182.
15. Obeidat WM, Akkawi M. Bionomics and control of pomegranate butterfly *Virachola* (*Deudorix*) *livia* (Klug) (Lepidoptera: Lycaenidae) in Northern Jordan. Dirasat-Agricultural Sciences, 2002;29(1):1-12.
16. Shevale BS, Khaire VM. Seasonal abundance of pomegranate butterfly, *Deudorix Isocrates*. Entomon. 1999;24:27-31.
17. Wohlfarter M, Giliomee JH, Venter E. A survey of the arthropod pests associated with commercial pomegranates, *Punica granatum* (Lythraceae), in South Africa. African Entomology. 2010;18:192-199.
18. Balikai RA, Kotikal YK, Prasanna PM. Status of pomegranate pests and their management strategies in India. Acta horticulturae. 2011;890:569-83.
19. Butani DK. Pests of pomegranate. Insects and fruits. Periodical Expert Book Agency, Delhi. 1979;228.
20. Pratt JS, Browne A, Browne NT, Bruzoni M, Cohen M, Desai A, Inge T, Linden BC, Mattar SG, Michalsky M, Podkameni D. ASMBS pediatric metabolic and bariatric surgery guidelines. Surgery for Obesity and Related Diseases. 2018 Jul 1;14(7):882-901.
21. Ramesh K, Thirumurugan V. Effect of seed pelleting and foliar nutrition on growth of soybean. Madras Agric. J. 2001;88(7):465-8.