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SEASONAL INCIDENCE OF ANAR BUTTERFLY AND IT'S CORRELATION WITH WEATHER PARAMETERS

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ABSTRACT
The field data (pooled for 2011 and 2012) recorded on pest incidence of pomegranate fruit borer (*Deudorix epijarbas*) at major pomegranate growing places of Kashmir Valley revealed that the highest mean pest incidence (24.58 %) was recorded in Srinagar, followed by Budgam where mean incidence of (20.83 %) was recorded, while as, low mean incidence (19.63 %) of pest was recorded in Ganderbal. The pest starts its activity in the 2nd fortnight of May and attained its peak in the 2nd fortnight of August during 2011 with incidence of 49.66, 43.66 and 43.33 per cent observed in Srinagar, Budgam and Ganderbal, respectively. However, during 2012, peak was recorded in the Ist fortnight of August with pest incidence of 53.00, 47.66 and 44.33 per cent recorded respectively in these districts.The maximum temperature, minimum temperature, maximum relative humidity, minimum relative humidity and rainfall and the population build up of the pest showed positive and significant correlation (r = 0.7830, 0.8782, 0.7219, 0.7610 and 0.5643) and (r = 0.6740, 0.9205, 0.7318, 0.5200 and 0.5293) during 2011 and 2012, respectively. Therefore, it can be concluded that fruit borer is causing a considerable damage to pomegranate fruits and also the weather factors extended their specific impact in building of borer population.

INTRODUCTION

Pomegranate (*Punica granatum* L.) is an important fruit crop cultivated in arid and semi-arid regions, serving nutritional, medicinal and aesthetic purposes. It belongs to genus *Punica* and family Punicaceae. It is grown in Iran, Spain, Moracco, Egypt, Afghanistan, Arabia, West Pakistan, India, Bangladesh, Burma, China, California and Japan. It is found from Kashmir to Kanyakumari. In India, it is regarded as a "vital cash crop" grown on an area of 1.5 lakh ha with a production of 11.0 lakh tons (Jadhav and Sharma, 2009).Its cultivation has spread all over the country due to its hardy nature, high yield with low maintenance cost and good keeping quality (Khodade *et al.,* 1990).

Many pests including 91 insects, 6 mites and 1 snail have been reported on pomegranate in India. The most obnoxious pest is pomegranate butterfly, *Deudorix (=Virachola) isocrates* Fab., also called as anar butterfly or pomegranate fruit borer which may destroy more than 50 per cent of fruits (Balikai *et al.,* 2011). Severe infestation of fruit borer has resulted in the reduction of pomegranate yield as well as cultivation of the fruit in the country. In Kashmir, an allied sps. of this insect, *Deudorix epijarbas* (Moore) has been recorded as a serious and predominant pest of pomegranate fruits (Zak-ur-Rab, 1980). The pest is a worst enemy of pomegranate fruit cultivation in Jammu and Kashmi causing economic damage. The pest attacks fruit from early stages till maturity of the fruit. The damage caused by infestation affects the quality of fruits which render them unfavourable for market.Thakur *et al.* (1995) revealed that mean fruit infestation of *D. epijarbas*in Jammu region was 25.33 per cent. Because of hard hitting of this pest, most of the pomegranate trees have been cut down by farmersin Kashmir Valley.

The status of this pest and its extent of damage to the crop in Kashmir valley has not been fully studied so far. To evolve an effective Integrated Pest management (IPM) strategy, knowledge of seasonal incidence of a pest and its relation with abiotic factors is a pre-requisite. Thus, timing of pest management can be initiated with the onset of pest incidence. Also the variability in their population and damage can be related to changes in the ambient environment. The paper deals with the current status of pomegranate fruit borer in Kashmir Valley.

MATERIALS AND METHODS

Field surveys were conducted at fortnight intervals from flower bud stage till harvest at major pomegranate growing locations of three districts viz., Srinagar (Nishat, Bemina and Botakadal), Budgam (Soibough, Beerwah and Chadoora) and Ganderbal (Raipur, Baderkund and Wussan). During each visit, ten fruits were examined randomly from four geographical directions from ten randomly selected trees for recording the incidence of fruit borer.

The specimens were properly processed, and got identified by Network project on Insect Biosystematics (NPIB), IARI, and New Dehli. The fruit borer damage was correlated with abiotic factors viz., maximum and minimum temperature, maximum and minimum relative humidity and rainfall.

Observations recorded:

Per cent incidence

The per cent incidence of fruit infestation was computed using following formula proposed by Kumar *et al*. (2002).

$$\text{Fruit damage (\%)} = \frac{\text{No. of damaged fruits}}{\text{Number damaged fruits} + \text{healthy fruits}} \times 100$$

The correlation coefficients (r) between the incidence of pomegranate fruit borer and weather parameters were also calculated.The data thus obtained from field experiment was subjected to statistical analysis for drawing inferences using standard statistical methods followed by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The survey was conducted on pomegranate fruit borer in district Srinagar, Budgam and Ganderbal from flower bud stage till harvest during 2011 and 2012. The data revealed that the pomegranate fruit borer, by and large is prevalent, with varied incidence from location to location (Plate-1). Earlier Zaka-ur-Rab (1980); Verma (1985) and Patyal and Nath (1993) also reported *D. epijarbas* as a serious pest of pomegranate in different parts of the country. During the present study it was found that larvae of pomegranate fruit borer, *D. epijarbas* caused damage to pomegranate from May to September. The results further revealed that the mean pest incidence ranged from 0-49.16, 0-44.66 and 0-43.00 per cent district Srinagar, Budgam and Ganderbal, respectively. The highest mean incidence (24.58%) was recorded in Srinagar, followed by Budgam which recorded 20.83 per cent incidence, while as low mean incidence (19.63%) was recorded in Ganderbal during 2011 and 2012 (Table-1, 2 and 3). Among the different locations of Srinagar, the highest mean pest incidence (26.55%) was recorded at Nishat where as the lowest mean pest incidence (23.05%) was recorded at Botakadal (Table-1). Similarly, in district Budgam, the highest mean pest incidence (22.60%) was recorded at Soibough whereas the lowest mean pest incidence (18.75%) was recorded at Chadoora locality (Table-2). The observations from district Ganderbal on the basis of pest incidence of pomegranate fruit borer revealed that the highest mean per cent incidence (21.65%) was recorded at Raipur whereas the lowest mean per cent incidence (17.40%) was recorded from Wussan locality (Table-3). The difference in per cent incidence may be due to altitude difference as reported by (Thakur *et al*., 1995) or due to

Table 1: Mean incidence of pomegranate fruit borer, *D. epijarbas* at various locations of district Srinagar during 2011 and 2012

Date of Observation	Mean per cent incidence			Mean
	Botakadal	Nishat	Bemina	
10th May	0.00	0.00	0.00	0.00[a] (1.000)
25th May	0.50	2.00	1.50	1.33[b] (1.521)
9th June	4.50	6.50	4.00	5.00[c] (2.439)
24th June	7.00	10.50	9.50	9.00[d] (3.153)
9th July	13.50	15.50	15.00	14.66[e] (3.956)
24th July	34.50	39.50	35.50	36.50[f](6.121)
8th August	46.50	52.50	48.50	49.16[h] (7.080)
23rd August	46.00	53.00	48.50	49.16[h] (7.080)
7th September	41.50	44.50	41.00	42.33[g] (6.581)
23rd September	36.50	41.50	38.00	38.66[f](6.295)
Mean	23.05[a] (4.335)	26.55[c] (4.721)	24.15[b] (4.489)	24.58
	C.D ($p \leq 0.05$)		C.V.	3.71
	Locations	:	0.105	
	Dates	:	0.192	

-Figures in the parenthesis are square root values; -Means followed by the same letter are not significantly different at 5% level

Table 2: Mean incidence of pomegranate fruit borer, *D. epijarbas* at various locations of district Budgam during 2011 and 2012

Date of Observation	Mean per cent incidence			Mean
	Soibough	Beerwah	Chadoora	
11th May	0.00	0.00	0.00	0.00[a] (1.000)
26th May	2.00	1.00	0.50	1.16[b] (1.457)
10th June	4.50	3.50	2.50	3.50[c] (2.112)
25th June	6.50	6.50	4.00	5.66[d] (2.571)
10th July	10.00	8.50	5.50	8.00[e] (2.982)
25th July	30.50	29.50	26.50	28.83[f] (5.459)
9th August	47.00	43.50	41.00	43.83[h] (6.693)
24th August	48.50	45.00	40.50	44.66[h] (6.755)
8th September	39.00	38.00	35.50	37.50[g] (6.203)
23rd September	38.00	36.00	31.50	35.16[g] (6.009)
Mean	22.60[c] (4.327)	21.15[b] (4.165)	18.75[a] (3.878)	20.83
	C.D ($p \leq 0.05$)		C.V. :	2.76
	Locations	:	0.106	
	Dates	:	0.195	

-Figures in the parenthesis are square root values;-Means followed by the same letter are not significantly different at 5% level

Table 3: Mean incidence of pomegranate fruit borer, *D. epijarbas* at various locations of district Ganderbal during 2011 and 2012

Date of Observation	Mean per cent incidence			Mean
	Raipur	Baderkund	Wussan	
12th May	0.00	0.00	0.00	0.00[a] (1.000)
27th May	1.00	0.5	0.50	0.66[b] (1.276)
11th June	4.50	2.00	2.50	3.00[c] (1.982)
26th June	6.50	4.00	3.00	4.50[d] (2.324)
11th July	10.00	8.50	6.00	8.16[e] (3.014)
26th July	31.50	28.50	23.50	27.83[f](5.360)
10th August	44.00	41.50	38.00	41.16[i](6.490)
25th August	46.00	44.50	38.50	43.00[i](6.628)
9th September	39.00	38.00	33.50	36.83[h] (6.147)
24th September	34.00	31.00	28.50	31.16[g] (5.668)
Mean	21.65[c] (4.323)	19.85[b] (3.987)	17.40[a] (3.730)	19.63
	C.D ($p \leq 0.05$)		C.V. :	3.57
	Locations	:	0.133	
	Dates	:	0.243	

-Figures in the parenthesis are square root values -Means followed by the same letter are not significantly different at 5% level

Table 4: Incidence of pomegranate fruit borer, *D. epijarbas* in relation to certain abiotic factors at Srinagar during 2011

Date of observation	Mean per cent incidence	Mean of max. temp. (°C)	Mean of min. temp. (°C)	Mean of max. RH (%)	Mean of min . RH (%)	Mean of Rainfall (mm)
10th May	0.00	25.31	8.15	74.73	44.40	0.41
25th May	0.66	28.33	10.20	70.86	35.80	0.29
9th June	4.33	28.23	12.08	68.66	34.60	0.72
24th June	8.00	31.33	14.64	72.60	46.00	2.79
9th July	13.66	30.40	16.79	71.80	52.60	0.48
24th July	36.66	29.90	16.57	76.60	50.40	0.93
8th August	45.33	33.47	17.86	77.66	51.53	0.80
23rd August	49.66	29.88	16.26	78.40	51.40	1.38
7th Sept.	40.66	29.53	17.01	84.66	54.73	2.30
22nd Sept.	37.00	26.93	14.14	88.33	56.66	1.06
Corr (r)	-	0.7830*	0.8782*	0.7219*	0.7610*	0.5643*

*Significant at 5%

Table 5: Incidence of pomegranate fruit borer, *D. epijarbas* in relation to certain abiotic factors at Srinagar during 2012

Date of observation	Mean per cent incidence	Mean of max. temp. (°C)	Mean of min. temp. (°C)	Mean of max. RH (%)	Mean of min. RH (%)	Mean of Rainfall (mm)
10th May	0.00	21.20	7.44	82.26	56.33	2.31
25th May	2.00	21.60	9.33	83.00	62.33	2.30
9th June	5.66	26.40	10.09	75.60	56.93	0.61
24th June	10.00	28.13	12.77	79.13	43.53	0.60
9th July	15.66	30.63	15.08	77.60	45.33	0.78
24th July	36.33	29.93	16.02	82.99	54.20	1.46
8th August	53.00	30.96	17.64	83.06	49.60	2.54
23rd August	48.66	30.10	18.35	83.40	54.66	2.01
7th Sept.	44.00	30.56	17.26	81.40	51.60	1.89
22nd Sept.	40.33	24.73	14.64	91.60	73.26	3.93
Corr (r)	-	0.6740*	0.9205 *	0.73818*	0.5200*	0.5923*

* Significant at 5%

susceptibility of cultivars and varied climatic factors (Moawad *et al*., 2011). Under present investigation, the pest incidence was found higher in district Srinagar which is at lower altitude as compared to district Budgam and disrict Ganderbal. Earlier this pest and its allied sp. *D. isocrates* have been recorded by various authors with varied level of infestation. Prasad *et al*. (1987) reported that *D. epijarbas* incidence varied between 12-94 per cent, while as, Parry and Pawar (1988) reported that *D. epijarbas* caused 50-60 per cent damage on pomegranate in Doda, Udhampur and Poonch districts in Jammu division (J &K). Thakur *et al*. (1995) revealed that mean fruit infestation of *D. epijarbas*in Jammu region was 25.33 per cent. Balikai *et al*. (2011) revealed, *Deudorix* (=*Virachola*) *isocrates*can destroy more than 50 per cent of pomegranate fruits. During the study it was observed that the pest started its activity in the 2nd fortnight of May and attained its peak in the 2nd fortnight of August during 2011 and recorded 49.66, 43.66 and 43.33 fruit damage in Srinagar, Budgam and Ganderbal, respectively. However, during 2012, peak was recorded in first fortnight of August with mean incidence of 53.00 47.66 and 44.33 per cent observed respectively in Srinagar, Budgam and Ganderbal districts. Also the incidence level of this pest

Plate 1: Infestation of *Deudorix epijarbas* on pomegranate fruit recorded at various locations

was found increased from July to August. The present findings are also in conformity with the work of Haseeb and Sharma (2007) who also reported that the incidence level of this pest was found increased between July to September with peak during August. Kumari *et al*. (2011) also found that the attack of fruit borer was maximum during the 3rd week of August. Elsayed and Bazaid (2011) also reported that the infestation rate of *V. livia* was higher in August (17.5 %) and lowest in October. However, Theran (1957) reported that the pomegranate butterfly was most active in summer in Punjab, while in Rajasthan and Himachal, it was most severe in July (Pareek, 1982; Patyal and Nath, 1993). Such variations in peak period of pest might be due to the changes in fruiting periods and climatic conditions in different parts of the country as also reported by Shevale and Khaire (1999).

As regards the influence of of weather factors on the incidence of fruit borer in the present investigation, it could be seen from the correlation coefficients that there existed positive and significant correlations between maximum temperature (r = 0.7830), minimum temperature (r = 0.8782), maximum relative humidity (r = 0.7219), minimum relative humidity (r = 0.7610), rainfall (r = 0.5643) and fruit borer during 2011 (Table-4). During 2012, there also existed positive and significant correlations (r = 0.6740, 0.9205, 0.7318, 0.5200 and 0.5293) between the population build up of the pest and independent effect of maximum temperature, minimum temperature, maximum relative humidity, minimum humidity and rainfall (Table 5). Shevale and Khaire (1999) also reported positive correlation of the pest with minimum temperature and relative humidity but pointed out negative correlation of the pest with maximum temperature. Similarly, Shukla and Khatri (2010) observed that maximum temperature and presence of brinjal fruit and shoot borer moth has the positive correlation (r = 0.319). Kumari *et al*. (2011) in their studies

revealed that the correlation between maximum temperature, minimum relative humidity and rainfall was positively correlated and significant with fruit borer damage. However, they reported that the correlation with maximum relative humidity was negative and significant.Mondal*et al.*(2014) while studying the impact of weathers factors on population of brinjal fruit and shoot borer revealed that borer population on fruits had significant positive correlation with maximum temperature (r = 0.541**) and minimum temperature (r = 0.559**) during 2006-2007. The population of insects is limited or enhanced by interplay of weather factors, mediated mainly via density independent relationships (Wallner, 1987).

Therefore, it can be concluded that fruit borer, *D. epijarbas*is causing a considerable damage to pomegranate fruits and warrants control measures right from the bud emergence so as to prevent the population build up further. Further it was also found that the weather factors particularly, the maximum temperature, maximum relative humidity and rainfall extended their specific impact on the pest build up. This information can be helpful to pomegranate growers to design the management strategy at the time when congenial conditions for growth and development of the pest exist.

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