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Seasonal incidence and management of major insect pests in bottle gourd *Lagenaria siceraria* (molina) standley

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Abstract

The present study was entitled “Seasonal incidence and management of major insect pest in bottle gourd [*Lagenaria siceraria* (molina) standley]” was conducted out at instructional horticulture farm, Rajasthan College of Agriculture, Udaipur during *Kharif*, 2025. The Present study was carried out to measure Seasonal incidence of major insect pest in bottle gourd field. The red pumpkin beetle (*A. foveicollis* Lucas) population appeared in June 2.1beetle/plant with 6.1 per cent leaf damage (25th SMW) and peaked at the first week of August 5.9 beetle/plant with 17.7 per cent leaf infestation (33th SMW). The population of red pumpkin beetle had a significant positive correlation with maximum temperature and a non-significant negative correlation with minimum temperature, while a non-significant negative correlation with relative humidity and negative significant with rainfall. The significant positive correlation with maximum temperature and negatively significant with rainfall of leaf damage per cent. The fruit fly (*Z. cucurbitae*) mean fruit infestation per cent was maximum at 56.1 per cent (34th SMW) with 58.1 per cent fruit fly trapped per week. The correlation studied was showed mean fruit infestation was positively significant with evening relative humidity ($r = 0.629$) and rainfall ($r = 0.537$). Similarly the number of fruit fly trapped per week was positively significant with evening relative humidity ($r = 0.592$) and rainfall ($r = 0.557$).

Keywords: Bottle gourd, red pumpkin beetle, leaf infestation, fruit fly, correlation

Introduction

Vegetable crops are crucial for the agricultural growth and nutritional stability of the country as they are abundant in vitamins, minerals, dietary fibers, phytochemicals (Wargovich *et al.*, 2000) and abundant in medicinal properties including cooling, diuretic, cardio-tonic, and anti-inflammatory effects (Anjaria *et al.*, 2012) ^[27].

Cucurbits comprise a significant category of vegetable crops cultivated globally, they are also extensively grown in India. Originating from tropical regions of America, Africa, and primarily Southeast Asia. The family Cucurbitaceae comprises more than 700 species of plants in about 90 genera (York *et al.*, 1992) ^[26]. Cucurbits are warm weather crop, this group includes a variety of trailing crops such as cucumber, watermelon, muskmelon, pumpkin, bottle gourd, ridge gourd, bitter gourd, pointed gourd, and snake gourd (Tripathi *et al.*, 2020) ^[20].

Bottle gourd, scientifically known as *Lagenaria siceraria* (Molina) Standley, is a member of the Cucurbitaceae family originated in tropical Africa and also referred as white-flowered gourd or calabash, lauki, ghia or doodhi and is now globally in tropical and subtropical regions for its edible fruit (Parkash *et al.*, 2023) ^[13]. It is widely cultivated in India during the *kharif* and summer seasons. In India, bottle gourd was cultivated across 249 thousand hectares, with a production of 3,951 thousand metric tonnes (DoAFW, 2024-2025). In Rajasthan, the cultivation area was 5,200 hectares, producing 26,369 metric tonnes (Anonymous, 2025) ^[1].

The composition of bottle gourd included 96.1 per cent moisture, 0.1 per cent fat, 0.5 per cent minerals, 0.6 per cent fiber, 2.5 per cent carbohydrates, 12 kcal of energy, 0.7 mg/100 g of iron, 0.03 mg/100 g of thiamine, 0.2 mg/100 g of niacin, and 0.01 mg/100 g of riboflavin (Srivastava *et al.*, 2002) ^[19]. It serves as a nutritious source of antioxidants and phenolic compounds.

It has 10.10 mg/100 g of ascorbic acid, 5.80 g/100 g of total sugars, 5.22 g/100 g of reducing sugars, and 1.31 g/100 g of starch (Milind and Satbir, 2011) ^[12].

The commercial cultivation of bottle gourd faces numerous challenges such as damage from insect pests, diseases, and unfavourable weather, all of which diminish both the quality and yield of bottle gourd production (Umar *et al.*, 2013) ^[22]. Bottle gourd is prone to various insect pests during different phases of its growth, including the melon fruit fly (*Zeugodacus cucurbitae* Coquillett), red pumpkin beetle (*Aulacophora foveicollis* Lucas), hadda beetle (*Epilachna dermurelli* Mulsent), whitefly (*Bemisia tabaci* Gennadius), aphid (*Aphis gossypii* Glover), leaf miner (*Liriomyza trifolii* Burgess), and mirid bug (*Nesidiocoris cruentatus* Ballard) (Bhowmik and Saha, 2017; Haldhar and Maheshwari, 2018 ^[6]; Halder *et al.*, 2021) ^[2, 4].

Knowledge of the seasonal incidence of insect pests of major insect pest in bottle gourd is vital for developing an effective management schedule for effective control of major insect pests. Many workers generated information on seasonal incidence (Bhowmik and Saha, 2017; Sarkar, 2022, Meena *et al.*, 2019), Konyak *et al.*, 2023) ^[2, 8, 11, 17] in a different region, but in semi - arid to sub humid region of Rajasthan, it is still lacking in semi - arid to sub - humid region of Rajasthan. Further climatic conditions will also change frequently. Hence, the study on the seasonal incidence of major insect pests of bottle gourd in relation to weather parameters was undertaken, and it can effectively be utilized in formulating a pest management programme.

Materials and method

To record the seasonal incidence of major insect pests of bottle gourd variety Pusa Naveen was sown first week of June in the eight plots, each plots 3.0 m × 3.0 m. The row to row distance was maintained at 3.0 m and plant to plant distance at 0.75 m. The recommended agronomic package of practices were adopted for raising the crop, excluding plant protection measures. The crop was left to natural infestation for recording the infestation of major insect pests of bottle gourd.

Methods of observations

Red pumpkin beetle

The observations of red pumpkin beetle was taken from whole plant. Five plants per plot were selected randomly and tagged, and observations on pest incidence was recorded at weekly intervals throughout the crop period. Direct count of the red pumpkin beetle (adults) and number of leaf damage were taken from five randomly selected plants in each plot, and the percent of leaf damage was calculated (Parkash *et al.*, 2023) ^[13].

- Number of red pumpkin beetle/ plant
- Number of leaf damage/plant.
- Leaf infestation will be calculated by following formula (Khan, M. M. H. (2012)) ^[7].

$$\text{Infestation of leaves (\%)} = \frac{\text{Number of infested leaves}}{\text{Total number of leaves}} \times 100$$

Fruit fly

The observations of fruit fly was expressed in terms of percent infestation. Total fruit infestation was recorded at seven day interval regularly beginning from ten day after flowering. The mean percent infestation fruit was worked on

the basis of number of infested fruit out of the total number of fruits as mentioned below (Preetha and Nadarajan, 2006) ^[14]

$$\text{Mean fruit infestation (\%)} = \frac{\text{Number of infested fruits}}{\text{total number of fruit}} \times 100$$

The incidence of fruit fly was also recorded by installing a fruit fly trap (Methyl eugenol lure) per plot and the number of fruit flies trapped in trap was recorded regularly and expressed as Mean catch per week (Sohrab *et al.*, 2018) ^[18]

Interpretation of data Simple correlation analysis was conducted between the major insect pests of bottle gourd (red pumpkin beetle and fruit flies) and abiotic factors such as temperature (maximum and minimum), relative humidity (morning and evening), rainfall, Statistical analysis was carried out using MS Excel programme.

Result and discussion

In the present investigation, an attempt was made of study the seasonal incidence of major insect pests of bottle gourd under abiotic climatic conditions of semi - arid to sub - humid region of Rajasthan during *Kharif*, 2025. Red pumpkin beetle and fruit fly were recorded as major insect pest in this region. The red pumpkin beetle population was associated with both the vegetative and reproductive stages of the crop. Meanwhile, the fruit fly population was associated with the reproductive stage of the crop.

Population of red pumpkin beetle and leaf infestation per cent:

The results showed that the population of red pumpkin beetle commenced in the second week of June (25th SMW) 2.1 beetle /plant, which gradually increased and reached its peak (5.9 beetles /plant) in the second week of August (32th SMW). After that, the population of red pumpkin beetles started declining. In the last observations (38th SMW), the population of red pumpkin beetle was lowest (5.5 beetle /plant). The peak population of red pumpkin beetle (5.9 beetles /plant) was recorded at 31.8 °C (maximum temperature), 24.1 °C (minimum temperature), 88.7 per cent morning relative humidity, 58.6 per cent evening relative humidity, 0.0 mm rainfall (Table 1 and Figure 1 and 2). The results of correlation studies indicated that the population of red pumpkin beetle on bottle gourd crop had a significant positive correlation with maximum temperature ($r=0.543$) and non-significant negative correlation with minimum temperature ($r= -0.057$), morning relative Humidity ($r= -0.377$), evening relative humidity ($r= -0.519$), rainfall ($r= -0.534$) negative significant.

The leaf infestation per cent caused by the red pumpkin beetle was initiated in the second week of June, with 6.1%. The infestation percent was increased and reached its peak in the 32th SMW (17.7% leaf infestation), followed by the 33th SMW (3.2%) and 34th SMW (15.4%). The correlation studies indicated that the leaf infestation per cent showed a significant positive correlation with maximum temperature ($r=0.543$) and non - significant correlation with minimum temperature, morning and evening relative humidity ($r=0.108$, $r=-0.395$, $r=-0.480$) and significant negative correlation with rainfall ($r= -0.602$).

The findings align with Rathod and Borad (2010) ^[16] noted that the highest incidence during the *Kharif* period (August-September) and summer (March-April). Kumar and Saini (2018) ^[9] further supported this by stating that red pumpkin beetle occurrence began during the 35th SMW and peak

population was observed during the first week of October (4.80 beetles /five plants). Tushar M. Ghule *et al.* (2014) ^[21] reported that maximum temperature was positively correlated with rainfall and conversely was positively

significant. Yadav *et al.* (2025) ^[25] reported that the leaf damage of red pumpkin beetle increased and peaked during 40th SMW (31.20% leaf damage) followed by 39th SMW (28.80%) and 41st SMW (24.80%).

Table 1: Incidence of Red Pumpkin beetle population and percent leaf infestation of bottle gourd

SMW	Period	Meteorological parameters					Population of red pumpkin beetle/plant	Leaf infestation (%)
		Temperature (°C)		Relative Humidity (%)		Total Rainfall (mm)		
	Max.	Min.	Mor.	Eve.				
25	18 Jun- 24 Jun	31.9	24.8	84.7	88.0	79.8	2.1	6.1
26	25 Jun-1 July	31.3	23.1	91.9	85.6	84.5	3.3	7.5
27	2 July-8 July	30.5	22.8	93.4	83.3	129.3	4.5	8.4
28	9 July-15 July	31.3	23.4	92.1	66.7	58.3	5.4	10.4
29	16 July-22 July	29.3	23.7	91.6	72.7	37.8	3.3	6.5
30	23 July-29 July	31.1	24.5	89.0	69.0	7.7	5.7	14.5
31	30 July-5 Aug	29.6	24.0	88.3	65.7	2.3	2.1	3.2
32	6 Aug-12 Aug	31.8	24.1	88.7	58.6	0.0	5.9	17.7
33	13 Aug-19 Aug	30.2	23.3	75.3	70.0	32.5	5.8	15.4
34	20 Aug-26 Aug	28.8	22.0	91.0	80.9	139.1	2.1	4.9
35	27Aug-2 Sept	30.4	23.0	91.6	77.0	45.9	4.9	12.0
36	3 Sept-9 Sept	29.7	22.8	91.9	69.4	117.9	1.6	2.1
37	10 Sept-16 Sept	31.5	22.3	83.7	54.1	0.0	5.7	14.5
38	17 Sept-23 Sept	31.9	22.0	77.9	64.6	59.0	5.5	10.2

SMW- Standard Meteorological Week

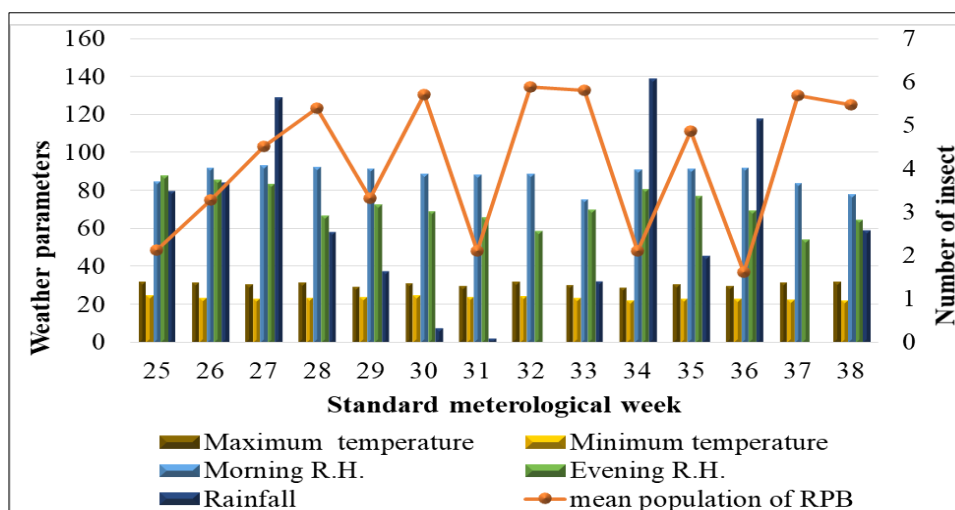


Fig 1: Incidence of Mean population of red pumpkin beetle of bottle gourd experimental field

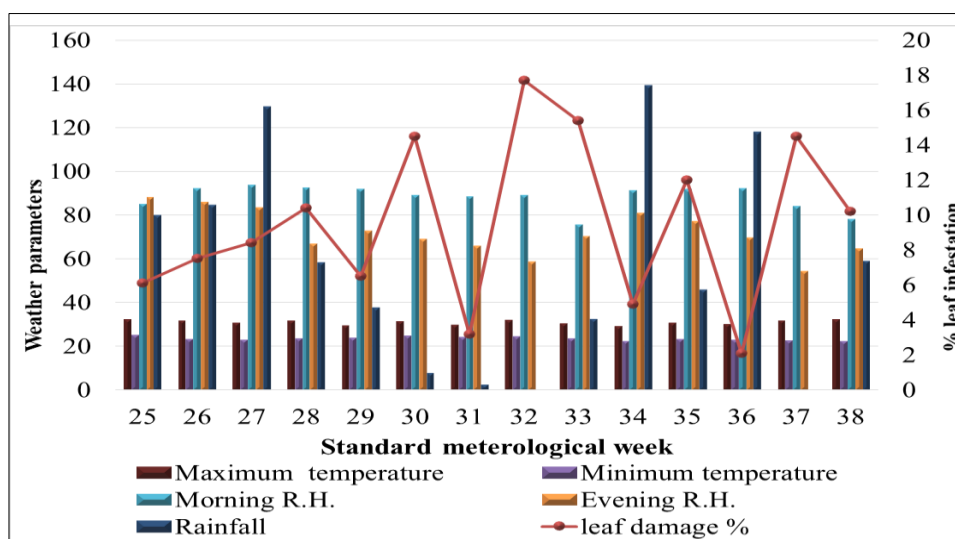


Fig 2: Incidence of red pumpkin beetle infestation per cent in bottle gourd experimental field

Fruit fly infestation per cent and mean number of fruit fly trapped per week

The seasonal incidence of fruit flies, based on per cent of infestations, began in the second week of June (25th SMW) with a 34.45% infestation per cent. This infestation increased and reached its peak at 56.1% in the last week of August (34th SMW). Significant peaks in infestation were also observed during the 33th SMW (33.9%) and 35th SMW (50.5%). Following these peaks, the infestation rate started to decline gradually (Table 2 Figure 3 and 4). The fruit fly infestation showed a non - significant negative correlation with minimum temperature ($r = -0.405$) and maximum temperature ($r = -0.165$) and morning relative humidity ($r = 0.512$). Evening relative humidity and rainfall was positive significant ($r = 0.629$, $r = 0.537$).

The seasonal incidence of fruit flies, based on number of fruit fly trapped per week, began in the second week of June (25th SMW) with a 33.15% trapped flies. This number of flies trapped increased and reached its peak at 58.1% in the

last week of August (34th SMW). Significant peaks in infestation were also observed during the 33th SMW (33.9%) and 35th SMW (49.6%). Following these peaks, the number of flies trapped started to decline gradually (Table 1). The fruit fly infestation showed a non - significant negative correlation with minimum temperature ($r = -0.224$) and maximum temperature ($r = -0.483$) and morning relative humidity ($r = 0.513$). Evening relative humidity and rainfall was positive significant ($r = 0.592$, $r = 0.557$).

The results of this investigation are in conformity with the findings of Wazir, Singh and Ramana (2019) [24] who reported a highly significant positive correlation between fruit fly population on summer squash and rainfall, morning relative humidity and evening relative humidity. The findings are in concurrence with Mandal *et al.* (2006) [10], Rajitha and Viraktamath (2010) [15] and Vignesh and Viraktamath (2015) [23]. Parkash *et al.* (2023) [13] reported that fruit fly infestation was positively correlated with the rainfall and evening relative humidity.

Table 2: Incidence percent fruit infestation and number of fruit fly trap in bottle gourd

SMW	Period	Meteorological parameters					Mean Percent fruit infestation	Mean no of fruit fly trapped/week
		Temperature (°C)		Relative Humidity (%)		Rainfall (mm)		
	Max.	Min.	Mor.	Eve.				
25	18 Jun- 24 Jun	31.9	24.8	84.7	88.0	79.8	34.45	33.15
26	25 Jun-1 July	31.3	23.1	91.9	85.6	84.5	38.9	37.4
27	2 July-8 July	30.5	22.8	93.4	83.3	129.3	45.6	46.1
28	9 July-15 July	31.3	23.4	92.1	66.7	58.3	47.66	48.23
29	16 July-22 July	29.3	23.7	91.6	72.7	37.8	37.2	38.5
30	23 July-29 July	31.1	24.5	89.0	69.0	7.7	33.3	32.5
31	30 July-5 Aug	29.6	24.0	88.3	65.7	2.3	29.7	30.4
32	6 Aug-12 Aug	31.8	24.1	88.7	58.6	0.0	25.2	24.7
33	13 Aug-19 Aug	30.2	23.3	75.3	70.0	32.5	32.5	33.9
34	20 Aug-26 Aug	28.8	22.0	91.0	80.9	139.1	56.1	58.1
35	27Aug-2 Sept	30.4	23.0	91.6	77.0	45.9	50.5	49.6
36	3 Sept-9 Sept	29.7	22.8	91.9	69.4	117.9	25.6	27.8
37	10 Sept-16 Sept	31.5	22.3	83.7	54.1	0.0	22.1	25.2
38	17 Sept-23 Sept	31.9	22.0	77.9	64.6	59.0	25.3	24.1

SMW- Standard Meteorological Week

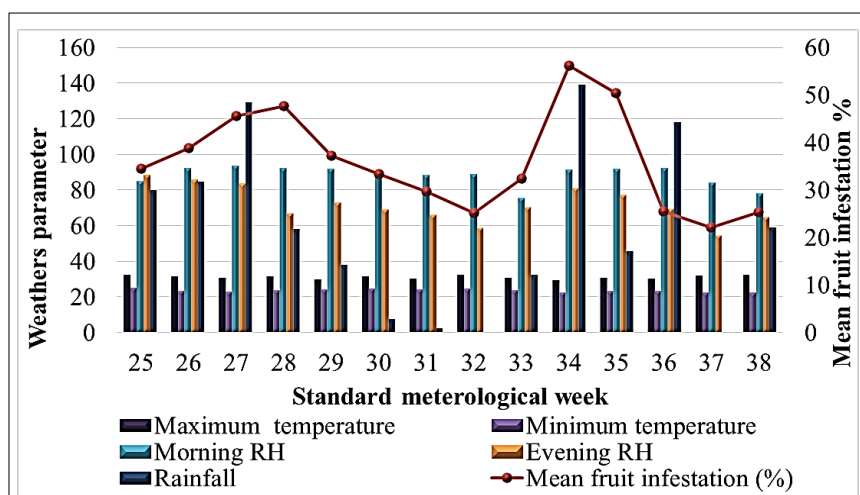


Fig 3: Incidence of mean fruit infestation percent of fruit fly in bottle gourd experimental field

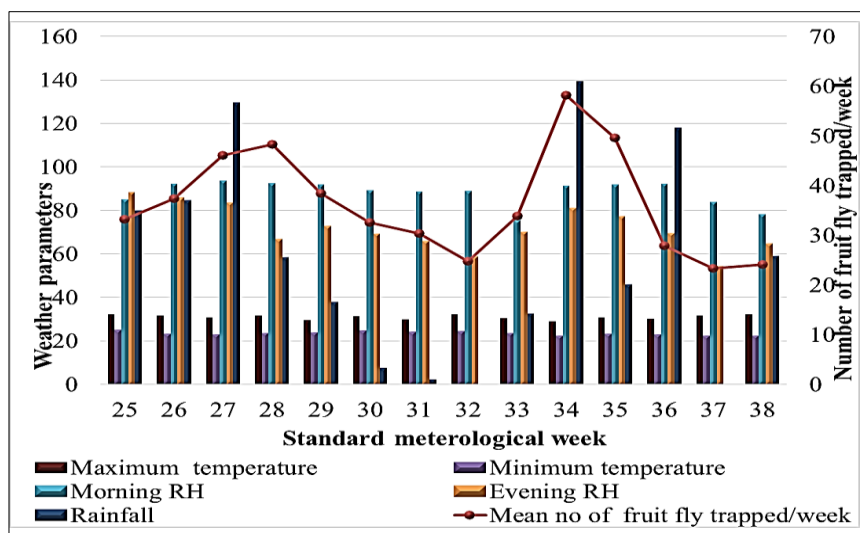


Fig 4: Mean number of fruit fly trapped per week in bottle gourd experimental field

Table 3: Correlation (r) value of red pumpkin beetle and fruit fly with different weather parameters

Weather parameters	Correlation coefficient (r)			
	Red pumpkin beetle		Fruit fly	
	Mean population of Red pumpkin beetle	Leaf infestation%	% Fruit infestation	Mean no of fruit fly trapped/week
Maximum temperature (°C)	0.543*	0.543*	-0.405 ^{NS}	-0.483 ^{NS}
Minimum temperature (°C)	-0.057 ^{NS}	0.108 ^{NS}	-0.165 ^{NS}	-0.224 ^{NS}
Relative Humidity morning (%)	-0.377 ^{NS}	-0.395 ^{NS}	0.512 ^{NS}	0.513 ^{NS}
Relative Humidity evening (%)	-0.519 ^{NS}	-0.480 ^{NS}	0.629*	0.577*
Rainfall (mm)	-0.534*	-0.602*	0.537*	0.548*

(*) Significance at 5% level NS - non-significance

Conclusion: The red pumpkin beetle incidence on bottle gourd ranged from 2.1 to 5.9 beetles/plant, with leaf infestation reached 17.7% in the 32th SMW. There was a significant positive correlation between red pumpkin beetle and leaf damage with maximum temperature. Fruit fly occurrence began in 25th SMW with initial infestation rates of 34.45% fruit and 33.15% trapped flies, increased to 56.1% fruit infestation and 58.1% trapped flies with the 34th SMW. Overall, pest populations were significantly influenced by environmental factors, with red pumpkin beetles correlating with maximum temperature and fruit flies with rainfall and evening relative humidity.

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