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SEASONAL INCIDENCE OF *Bactrocera dorsalis* ON BER AND ITS RELATIONSHIP WITH WEATHER PARAMETERS

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ABSTRACT

A field study was conducted during 2022–23 at the Fruit Research Station, Khengarvav, Junagadh Agricultural University, Junagadh, Gujarat, India, to investigate the seasonal incidence of *Bactrocera dorsalis* on ber and its relationship with weather parameters. Fruit fly activity was monitored on ber from the 45th standard meteorological week (SMW) of 2022 to the 9th SMW of 2023. The fruit fly population ranged from 32.34 to 92.20 flies per trap, with the highest incidence recorded during the 2nd SMW (92.20 flies/trap), while the lowest population (32.34 flies/trap) was observed during the 45th SMW. Peak activity was recorded from the 50th SMW of December to the 3rd SMW of January. Correlation analysis revealed that evening relative humidity ($r = 0.690^{**}$) had a highly significant positive association with fruit fly population, whereas maximum temperature ($r = -0.687^{**}$) and bright sunshine hours ($r = -0.641^{**}$) exhibited highly significant negative correlations. Morning relative humidity ($r = 0.482^{*}$) showed a significant positive correlation, while minimum temperature ($r = -0.509^{*}$) and evaporation ($r = -0.516^{*}$) were significantly negatively correlated with fruit fly abundance. The R^2 value of 0.8691 indicates that these six weather parameters [maximum temperature (X_1), minimum temperature (X_2), morning relative humidity (X_4), evening relative humidity (X_5), Bright sunshine hours (X_7) and evaporation (X_9)] jointly accounted for 86.91% of the total variation in the fruit fly population per trap in ber.

Key words : Ber, *Bactrocera dorsalis*, Weather parameter, Multiple regression analysis.

Introduction

Ber (*Ziziphus mauritiana* Lamk.), a member of the Rhamnaceae family, is an important fruit crop widely cultivated in India and several Asian countries. Owing to its wide adaptability to arid and semi-arid climates, drought tolerance and ability to thrive on marginal soils, it is widely grown in states such as, Gujarat, Rajasthan, Punjab and Haryana (Bal and Uppal, 1992). India ranks first among ber growing countries in the world. In Gujarat, ber is cultivated on approximately 10,680 hectares, with an average annual production of 1,03,090 tonnes (Anonymous, 2022).

Despite its economic importance, ber productivity is substantially constrained by insect pests and diseases. More than 80 insect pest species have been reported on ber (Butani, 1979), with up to 130 species recorded in

India (Lakra and Bhatti, 1985). Among them, the ber fruit fly is the most destructive pest, causing severe fruit damage, deterioration in fruit quality and considerable economic losses. Fruit flies (Diptera: Tephritidae) constitute one of the largest families of economically important insect pests, comprising nearly 4,000 species worldwide, of which about 392 species have been recorded in India (Kapoor, 1993; White and Elson-Harris, 1992).

Although, the economic importance of ber fruit fly is well recognized, information on its seasonal incidence under different agro-climatic conditions remains limited. Since insect population dynamics are strongly influenced by temperature, relative humidity, rainfall and other environmental factors, studying seasonal incidence is essential for understanding pest fluctuations and

developing effective forecasting models and timely management strategies. Therefore, the present study was carried out to investigate the seasonal incidence of ber fruit fly in relation to weather parameters.

Materials and Methods

To study the seasonal incidence of the ber fruit fly, a study was done at Fruit Research Station, Khengar vav, Junagadh Agricultural University, Junagadh during the year 2022-23 from fruiting to harvesting on previously grown gola ber trees. The age of ber trees was 35 years and planted at a spacing of 8 m x 8 m. The field under the experiment was kept free from any pesticides. All the agronomical practices were adopted as per the recommendation. Five traps per hectore were kept in the ber orchard at a height of 2 m from the ground. Observation of the number of trapped fruit flies was recorded at weekly intervals. The mean number of trapped fruit flies was worked out separately.

The weekly meteorological data was obtained from the meteorological observatory of Junagadh Agricultural University, Junagadh. With a view to study the impact of different abiotic factors on fruit fly population, a simple correlation and regression analysis between fruit fly population and weather parameters was worked out.

Results and Discussion

The data presented in Table 1 revealed that the population of fruit fly varied from 32.34 to 92.20 fruit flies per trap from the 45th SMW to the 9th SMW. In 2nd SMW, highest fruit fly population (92.20 fruit flies/trap) was observed followed by 90.30 fruit flies per trap in the 3rd SMW. After the 3rd SMW, the population of fruit fly declined steadily. The lowest fruit fly population (32.34 fruit flies/trap) was observed at 45th SMW. The population of fruit fly started increasing chronologically from November and attained the first peak population in 50th SMW in December which was 75.90 fruit flies per trap. In the 51st SMW the numbers of fruit fly population decrease slightly and chronologically increased during 52nd SMW of December and 1st SMW of January.

The fruit fly population attained the highest peak in 2nd SMW in January, which was 92.20 fruit flies per trap. Then slightly decrease in fruit fly population in 3rd SMW. Then, population of fruit fly decreases drastically in 4th SMW which was 57.37 fruit flies per trap. Then again in the 5th SMW population of fruit fly increased to 62.30 fruit flies per. From the 5th SMW population of fruit fly started to decline steadily till the 9th SMW. In the 7th SMW population of the fruit fly was slightly decreased to 52.36 fruit flies per trap. In the 8th SMW the population of fruit flies increased to 58.36 fruit flies per trap. After

8th SMW the population of fruit flies were decreased to 42.30 fruit flies per trap in 9th SMW.

The highest peak activity of fruit fly was observed during the month of December and January (Singh and Vashistha, 2002; Ranjitha and Shashidhar, 2006). Lakra *et al.* (1979) described that the fruit fly damage was maximum during January whereas fruit fly infestation was minimum in March. Patel *et al.* (2022) recorded the population of fruit fly from 45th SMW to 11th SMW in the season is as follows 46.7, 49.2, 59.4, 70.3, 79.3, 89.6, 68.0, 56.7, 51.3, 39.9, 33.6, 35.8, 42.1, 56.2, 66.5, 90.1, 102.5, 116.5 and 129.5 fruit flies/trap/week, respectively. Thus, the present investigation found close results with earlier works.

Correlation studies between *B. Dorsalis* and different weather parameters

A study on the effect of various weather parameters on the fluctuation of fruit fly population on ber from November 2022 to February 2023 (Table 2) indicated that fruit fly population had a highly significant positive correlation with evening relative humidity ($r = 0.690^{**}$). While, maximum temperature ($r = -0.687^{**}$) and bright sun shine hours ($r = -0.641^{**}$) were found negatively highly significant correlated with fruit fly population. Morning relative humidity ($r = 0.482^{*}$) had a positive significant correlation with fruit fly population. While, minimum temperature ($r = -0.509^{*}$) and evaporation ($r = -0.516^{*}$) had a negative significant correlation with fruit fly population. Temperature fluctuation and relative humidity fluctuation were negatively non-significant correlation and wind speed had a positive non-significant correlation with fruit fly population which was $r = -0.396$, $r = -0.239$ and $r = 0.233$, respectively.

The activity of fruit fly was found positively significant correlated with relative humidity (Acharya *et al.*, 2017; Patel *et al.*, 2019; Chandra *et al.*, 2022 and Jena *et al.*, 2022). Bright sun shine hours were found negatively correlated with fruit fly population (Jena *et al.*, 2022). However, wind speed found non-significant positive correlation with fruit fly activity (Acharya *et al.*, 2017). While, maximum temperature was negatively significant correlated with fruit fly population (Sarada *et al.*, 2001 and Verghese *et al.*, 2006). Furthermore, Evaporation was significantly negatively correlated with fruit fly population. Thus, the present investigation has given conformation for earlier works.

Multiple regression study between population of ber fruit fly and weather parameters

Based on regression analysis by taking fruit flies population (Y) as a dependent variable and six weather

Table 1 : Seasonal incidence of ber fruit fly with weather parameters (November 2022 to February 2023).

S. no.	SMW	Month	Mean no. of fruit fly/trap	Temperature (°C)			Relative Humidity (%)			BSS (hr)	WS (km/hr)	Evaporation (mm)
				Max	Min	Temperature Fluctuations	Morning	Evening	RH Fluctuations			
				X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉
1	45	November	32.34	35.4	18.2	17.3	61.1	28.4	32.7	9.0	2.7	4.3
2	46		59.36	33.9	16.9	17.0	71.9	27.3	44.6	9.1	2.4	4.3
3	47		65.81	32.3	13.8	18.5	66.7	26.0	40.7	9.5	2.3	4.2
4	48		67.20	32.6	14.9	17.7	67.6	30.9	36.7	9.2	2.6	4.3
5	49	December	66.30	31.4	15.3	16.1	67.6	31.9	35.7	8.2	3.8	4.5
6	50		75.90	31.6	17.7	13.9	72.9	39.1	33.7	5.7	4.3	4.4
7	51		70.52	32.2	17.3	14.9	63.4	26.0	37.4	8.1	4.0	5.1
8	52		81.27	28.7	11.7	17.0	70.3	30.3	40.0	8.3	4.5	4.5
9	1	January	86.46	27.2	13.3	13.9	68.3	34.7	33.6	6.7	5.4	4.7
10	2		92.20	30.0	15.3	14.7	78.4	36.4	42.0	4.2	3.5	3.6
11	3		90.30	27.8	9.4	18.3	73.0	35.6	37.4	8.9	5.0	4.6
12	4		57.37	25.7	13.7	12.0	58.0	31.7	26.3	9.0	7.6	6.0
13	5	February	62.30	30.1	13.8	16.3	67.4	26.9	40.6	8.4	4.8	5.2
14	6		55.36	32.9	14.0	19.0	70.1	25.7	44.4	9.3	3.7	5.2
15	7		52.36	35.4	13.8	21.6	72.0	20.0	52.0	9.5	3.9	6.0
16	8		58.36	35.8	14.5	21.3	75.1	19.0	56.1	9.4	3.6	5.0
17	9		42.30	36.5	17.1	19.4	68.0	17.4	50.6	9.5	3.9	6.3

SMW: Standard Meteorological Week, Mor. RH: Morning Relative Humidity, Eve. RH: Evening Relative Humidity, BSS: Bright Sunshine hours, WS: Wind Speed.

Table 2 : Correlation coefficient (r) of weather parameters with fruit fly population (November 2022 to February 2023) (n=17)

S. no.	Parameter	Correlation co-efficient
1	Maximum Temperature (°C)	-0.687**
2	Minimum Temperature (°C)	-0.509*
3	Temperature Fluctuation	-0.396
4	Morning Relative Humidity (RH ₁), %	0.482*
5	Evening Relative Humidity (RH ₂), %	0.690**
6	Relative Humidity Fluctuation	-0.239
7	Bright Sunshine Hours (BSS), hrs/day	-0.641**
8	Wind Speed, kmph	0.233
9	Evaporation, mm	-0.516*

Table 3 : Multiple regression analysis between mean ber fruit fly population and selected weather parameters in 2022-23.

Weather parameters	Partial “b” value	“t” value for partial “b”	R ²	Intercept
Maximum temperature	-3.57	-1.70	0.8691	141.42
Minimum temperature	-0.52	-0.22		
Morning relative humidity	1.40	1.66		
Evening relative humidity	-0.34	-0.44		
Bright sunshine hours	-1.99	-0.60		
Evaporation	-5.14	-1.30		

parameters (X) as independent variables following regression model was obtained:

$$\hat{Y} = 141.42 - 3.57X_1 - 0.52X_2 + 1.40X_4 - 0.34X_5 - 1.99X_7 - 5.14X_9$$

Where,

$\hat{Y}$ = Response of fruit fly population on ber per trap

X_1 = Maximum temperature

X_2 = Minimum temperature

X_4 = Morning relative humidity

X_5 = Evening relative humidity

X_7 = Bright sun shine hours

X_9 = Evaporation

The regression model (Table 3) indicated that decrease in 1°C of maximum and minimum temperature fruit fly population increase by 3.57 and 0.52 numbers per trap, respectively. Similarly, increase in 1% morning and decrease in 1% evening relative humidity increase in fruit fly population by 1.40 and 0.34 numbers per trap, respectively. However, decrease in 1 unit of bright

sunshine hours the fruit fly population was increased by 1.99 numbers per trap. Furthermore, decrease in 1 mm evaporation the fruit fly population was increased by 5.14 fruit fly per trap. The R² value (0.8691) determined that the main six weather parameters jointly contributed 86.91 per cent of the total variation of fruit fly population per trap in ber.

Conclusion

The peak incidence of fruit fly population was observed between the 50th SMW of December (75.90 fruit fly/trap) and the 3rd SMW of January (90.30 fruit fly/trap), corresponding to the period of maximum availability of ripened fruit. Conversely, the lowest fruit fly population was observed during the 45th SMW and continued through the 9th SMW. These findings highlight the seasonal variation in fruit fly activity, directly

influenced by fruit ripening and availability. Correlation analysis revealed that evening relative humidity had a highly significant positive effect on fruit fly population, whereas maximum temperature and bright sunshine hours showed a highly significant negative effect. Morning relative humidity was positively significant, while minimum temperature and evaporation were negatively significant with fruit fly population. Regression analysis indicated that six weather parameters together explained 86.91% of the variation in fruit

fly population, highlighting the strong influence of weather conditions on its seasonal incidence.

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