Original Research Article

Monitoring of Melon Fruit Fly, *Zeugodacus cucurbitae* using Para-pheromone Traps in Bitter Gourd (*Momordica charantia* L.)

ABSTRACT

Investigations were carried out on monitoring of melon fruit fly, *Zeugodacus cucurbitae* on bitter gourd (*Momordica charantia* L.) using para-pheromone traps during *Kharif*, 2018-19 at CCS HAU, Hisar. The incidence of *Z. cucurbitae* started gradually increased from 31st to 42nd Standard Meteorological Week (SMW) corresponding to the 1st week of September to 3rd week of October. Higher number of fruit flies (on average 9.5 to 40.5 flies/trap) were recorded in the month of September to first fortnight of October with a peak of 40.5 flies/trap during 37th standard meteorological week. Correlation analysis with various weather parameters indicated that maximum temperature (r = 0.611*), morning relative humidity (0.590*) and rainfall (0.747**) had significant positive correlation with trap catches population of melon fruit fly. The present findings also revealed that the influence of all-weather parameters was high and significant on trap catches population of the adult male melon fruit fly (R^2=0.76).

Keywords*:* *Monitoring, Zeugodacus cucurbitae, trap catches, SMW, correlation*

1. INTRODUCTION

India is a one of the leading producers of fruits and vegetables, which serve as an important source of nutrition for its enormous population. Bitter gourd, *Momordica charantia* L. belonging to family Cucurbitaceae is widely cultivated vegetable crop across Asian countries. Fruits of this vegetable have the richest nutritive value among cucurbits (Kumari *et al*., 2017) as they are good source of carbohydrates, proteins, vitamins and minerals. Several health benefits have been reported, with reference to treatment of cancer (Grover and Yadav, 2004) and anti-diabetic properties (Joseph and Jini, 2013). Insect pests and diseases are the two major limiting factors (Dhandapani *et al.,* 2003) in increasing the yield potential in cucurbits and cole crops. Numerous insect-pests are known to attack bitter gourd during different crop growth stages, among which, melon fruit flies (*Zeugodacus cucurbitae* and *Z. tau*) have been recorded as a serious pest infesting on the most economic part of bitter gourd crop

(Gaddanakeri and Rolania, 2020). The most serious of them all is melon fruit fly, *Z. cucurbitae*, which causes severe damage to cucurbits and is a cosmopolitan pest which prefers tropics and subtropics (Drew, 1992). It causes losses up to the extent of 30 to 100 per cent in cucurbits (Dhillon *et al*., 2005). In several other case studies, it is reported to cause fruit infestation of 31.27 and 28.55 per cent on bitter gourd and water melon, respectively (Singh *et al*., 2000). It is very difficult to manage this particular pest which belong to the family Tephritidae, because except adults remaining life stages are concealed or hidden, thus the usual target for its management is the adult stage. Therefore, monitoring pest population in relation to weather parameters which helps in determining appropriate time of action and suitable method of management. This information is very much necessary for formulating IPM strategy to manage melon fruit flies. Keeping this in mind, the present investigation was carried out on monitoring adult males of *Z. cucurbitae* in relation to weather parameters.

2. MATERIAL AND METHODS

In the present investigation, the population of male adults of *Z. cucurbitae* were monitored using para-pheromone (cue lure) traps during *kharif* season of 2018-19 at Vegetable Research Farm, CCSHAU, Hisar. The current study utilized inexpensive bottle traps. Three windows of one inch each were made with the help of a knife at three inches from top of used 1 litre water bottle. A small hole was carved on the center of cap or lid. A wire of ten-inch length was taken to make a knot at the center of the lid so as to make a loop. The wire inside the bottle was tied to cue lure bait in hanging position. The bottles were partially filled with soap water. Cue lure was purchased from M/s Sisco Research Laboratories Pvt. Ltd., Mumbai.

Installation of two cue lure traps was done immediately after sowing. The traps were refilled every week with soap water and every two weeks with cue lure. The adult males of *Z. cucurbitae* were separated based on typical wing pattern and were gathered, sorted, and recorded on a weekly basis. The collected data was subjected to correlation and regression analysis with the abiotic factors *viz*., minimum and maximum temperature, morning and evening relative humidity, wind speed, sunshine hours and rainfall (Table -1 & 2).

2.1 STATISTICAL ANALYSIS

The data on weather parameters *viz*., maximum and minimum temperature, morning and evening relative humidity, sunshine hours, wind speed, evaporation and rainfall were collected from Meteorological Observatory, College of Agriculture, CCSHAU, Hisar, Haryana (Table 3). The correlation between trap catches of *Z. cucurbitae* and various weather parameters was calculated by the Pearson's correlation coefficient using SPSS 22.0 software.

3. RESULTS AND DISCUSSION

The monitoring of adult males *Z. cucurbitae* on bitter gourd was carried out from August 2018 (31st standard meteorological week) to October 2018 (42nd standard meteorological week). Higher number of fruit flies (on average 9.5 to 40.5 flies/trap) were recorded during the month of September to first fortnight of October. The maximum numbers of fruit flies (40.5 flies/trap) were recorded during 37th standard meteorological week (Figure – 1). The number of fruit flies decreased drastically in further weeks, as the crop season was coming to an end. Along with monitoring, investigation was also carried out to find out the relationship between trap catches population of melon fruit fly, *Z. cucurbitae* and weather parameters such as maximum and minimum temperature, morning and evening relative humidity, rainfall, evaporation, bright sunshine hours and average wind speed. Maximum temperature (r = 0.611*), morning relative humidity (0.590*) and rainfall (0.747**) had significant positive correlation with trap catches population of melon fruit fly. Evening relative humidity (r = 0.247) and bright sunshine hours (r = 0.304) shown positive correlation whereas, minimum temperature (r = -0.236) and average wind speed (-0.043) had negative and non-significant correlation with the trap catches population of melon fruit fly (Table-1; Figure-2A and 2B). The multiple regression analysis between trap catches population of melon fruit fly and weather parameters presented in table-2 revealed that all weather parameters collectively accounted for 76 per cent variability in trap catches population of melon fly adults. The present findings revealed that the influence of all-weather parameters was high and significant on trap catches population of the adult male melon fruit fly (R^2=0.76).

Seasonal variation in weather factors plays an important role in the reproduction, growth, development, and distribution of insects and influences their population dynamics and infestation rates

(Dhaliwal and Arora, 2001). The present findings are almost in consistent with the findings of Pawar *et al*. (1991) who recorded maximum number of trap catches population of *Z. cucurbitae* in bitter gourd during the first fortnight of October. In the study conducted by Khan *et al*. (2003) rainfall showed to have the greatest effect on fruit fly population dynamics of fruit flies. The cue lure baits which were replaced every fifteen days attracted males of *Z. cucurbitae* only. The present results are in consistent with the observations of Vignesh and Viraktamath (2015) and Boontop *et al*. (2017) who reported that cue lure traps attracted only male *Z.cucurbitae.*

The trap catches population of fruit fly was significantly and positively correlated with the maximum temperature, rainfall and morning relative humidity and positive correlation existed with evening relative humidity and bright sunshine hours and negative correlation was existed with minimum temperature, evaporation and average wind speed (km/h). Weather factors, particularly temperature and rainfall, are the main meteorological parameters influencing the distribution of fruit flies (Amin *et al*., 2019). They tend to hide and aggregate under the dried leaves of bushes and trees during the cold season. High temperatures, long periods of sunshine have strong influences on their reproduction and abundance (Lee *et al*., 1992). Present findings are supported by Das *et al*. (2017) who reported that trap catches of *Z. cucurbitae* showed a highly significant positive correlation with maximum temperature and morning relative humidity in pumpkin. Hossain *et al*. (2019) recorded higher number of *Z. cucurbitae* during early rainy seasons of 2017 and 2018, which declined during the tail end of rainy season. Sunil *et al*. (2016) observed peak infestation of *Z. cucurbitae* on bitter gourd during last week of September (52%) and recorded significant positive correlation of fruit fly incidence with rainfall (r = 0.71) and positive correlation with maximum temperature (r = 0.35) and maximum RH (r = 0.59). The present study also indicated that the influence of weather parameters was high and significant on trap catches population of melon fruit fly (R^2=0.76). The present findings are in conformity with the readings of Vignesh and Viraktamath (2015) who recorded multiple regression value of R^2=0.762 when regression analysis was carried out between incidence of *B. cucurbitae* with respect to various weather parameters in bitter gourd. Similarly in the investigations conducted by Nair and Pal (2020), The weather factors together influenced the fruit fly population to the extent of 79 percent. However, Khan *et al.* (2010) recorded multiple linear regression value of R^2=0.40 in bitter gourd, which indicated the role of weather parameters *i.e.*, 40% with

respect to melon fly trap catches. This indicated that variations or fluctuations in weather conditions at different regions tend to play varied role in maintaining the populations of *Z. cucurbitae.*

Table 1: Correlation between various weather parameters in relation to *Z. cucurbitae* trap catches population during *Kharif*, 2018

Weather parameters	Fruit fly population
Maximum temperature (ºC)	0.611*
Minimum temperature (ºC)	-0.236
Relative humidity - Morning (%)	0.590*
Relative humidity - Evening (%)	0.247
Rainfall (mm)	0.747**
Evaporation (mm)	-0.359
Bright sunshine hours	0.304
Average wind speed (Km/h)	-0.043

*Correlation is significant at P ≤ 0.05; **Correlation is significant at P ≤ 0.01

Table 2: Multiple regression analysis between weather parameters and trap catches population of *Z. cucurbitae* during *Kharif*, 2018

	Regression equation	R^2
Trap catches of melon fruit fly	Y = -360.63+3.12 T_{max}+1.94 T_{min}+2.74 RHm – 0.32 RHe – 5.6 SSH + 0.91 RF – 7.47 WS + 13.94 EV	0.76

T_{max}: Maximum temperature (ºC), T_{min}: Minimum temperature (ºC), RHm: Relative humidity - Morning (%), RHe : Relative humidity - Evening (%), SSH : Bright sunshine hours, RF : Rainfall (mm), WS : Average wind speed (Km/h) and EV : Evaporation (mm).

4. CONCLUSION

The incidence of *Z. cucurbitae* was found throughout the experimental period. The maximum trap catches (40.5 flies/trap) observed during 3rd week of September (37th SMW). The correlation coefficient data maximum temperature, morning relative humidity and rainfall had significant positive correlation with trap catches population of melon fruit fly. Influence of all-weather parameters had high impact on trap catches population of the adult male melon fruit fly All this information, may be useful to predict and forecast the *Z.*

cucurbitae population during the *Kharif* season. Region specific crop simulation dynamics models can be prepared so that farmers can adopt the control measures well in advance to save the fruit yield. It is usually desirable to gather data from many geographic regions in order to produce more precise predictions in significantly fluctuating temperatures even for a certain place.

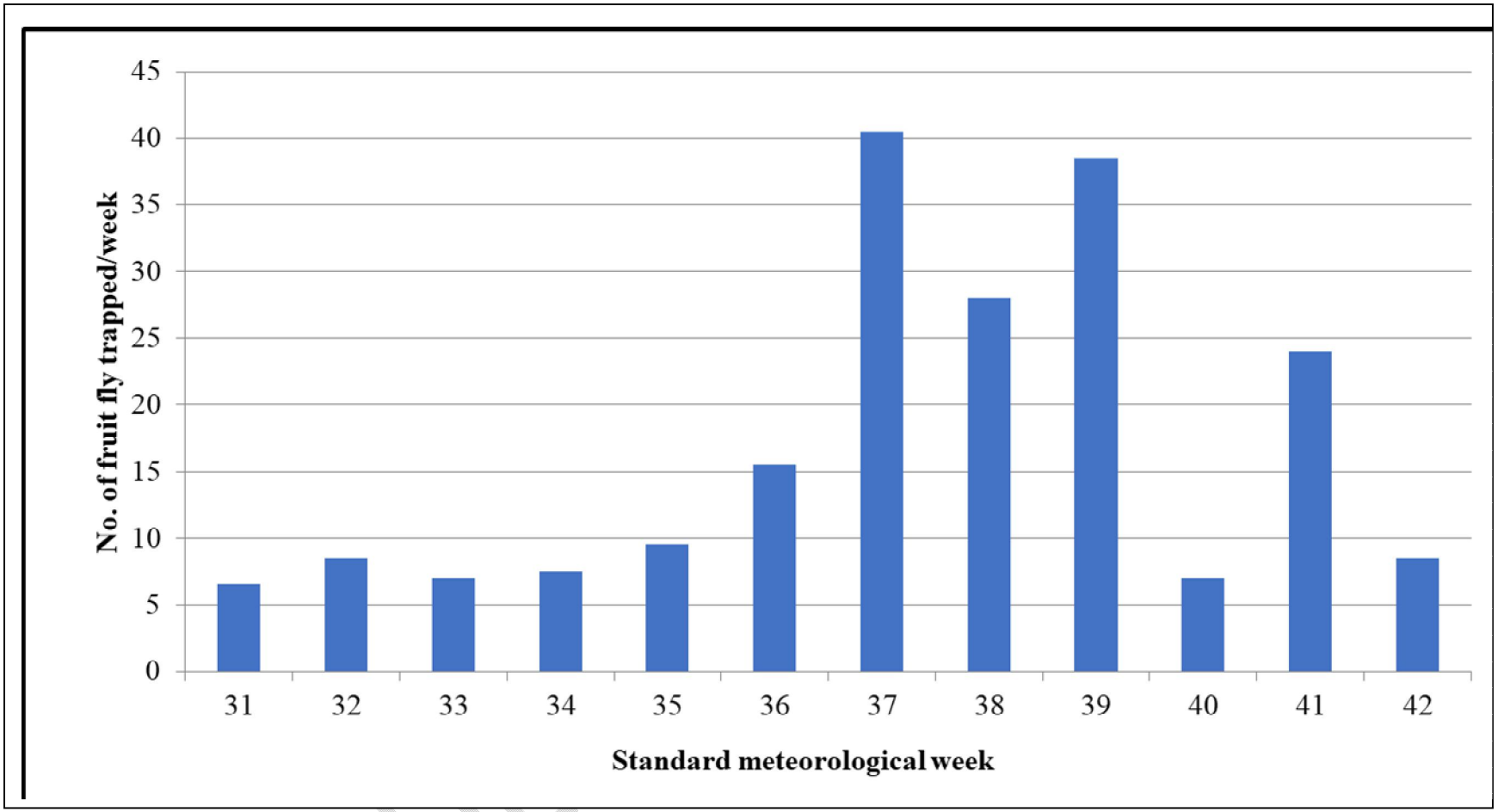

Fig. 1: Trap catches of melon fruit fly at vegetable research farm, CCSHAU, Hisar

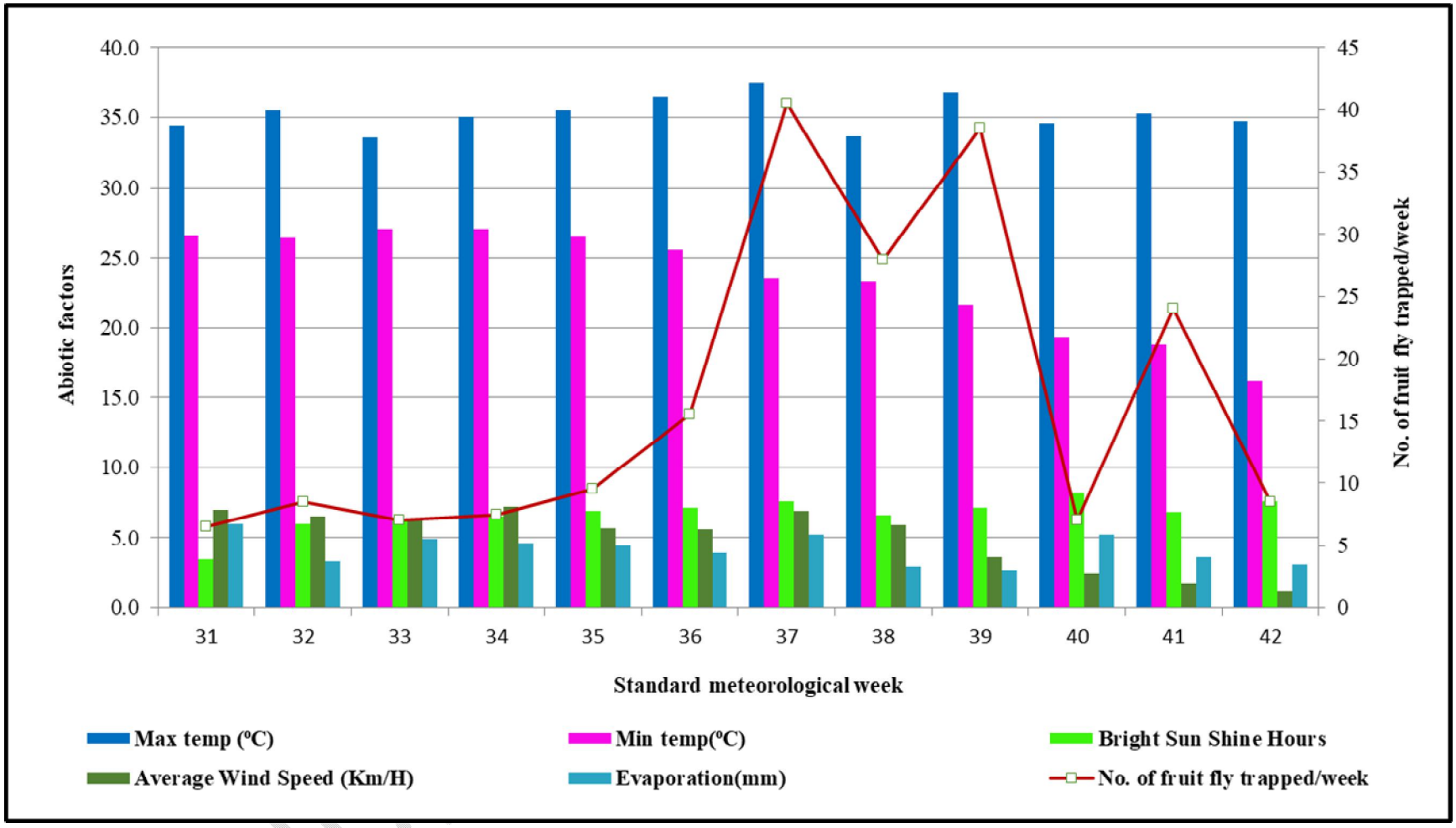

Fig. 2 (A): Influence of weather factors on the trap catches population of *Z. cucurbitae*

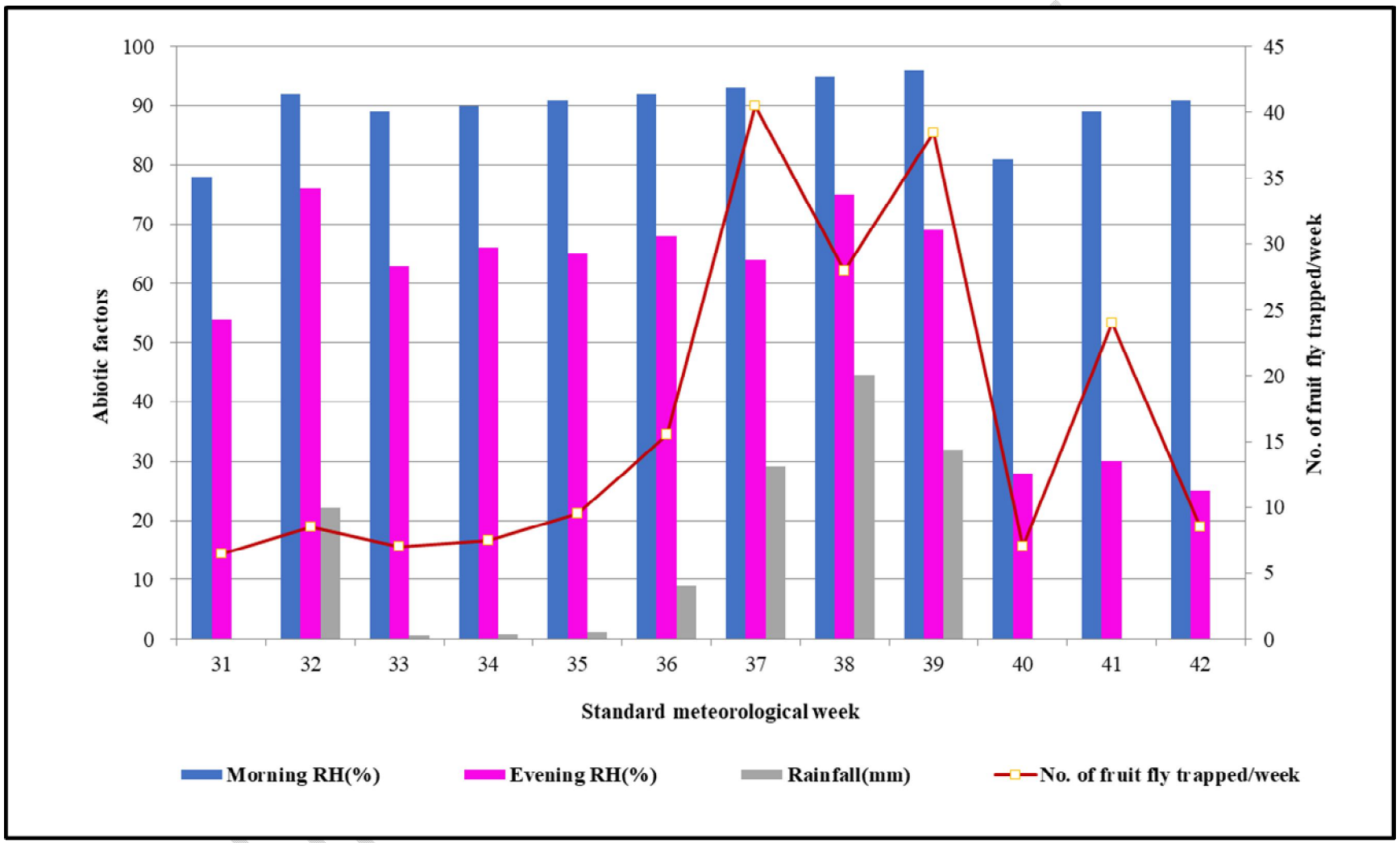

Fig. 2 (B): Influence of weather factors on the trap catches population of *Z. cucurbitae*

Table 3. Average weather data at Hisar during the experiment season 2018

Sl. No.	Standard Meteorological Week	Max. Tem. (^{o}C)	Min. Tem. (^{o}C)	Morn. RH (%)	Even. RH (%)	Rainfall (mm)	Evaporation (mm)	Avg. wind speed (km/h)	Bright Sun Shine Hours
1	31	34.4	26.6	78	54	0	6	7	4
2	32	35.5	26.4	92	76	22.1	3.3	6.5	6
3	33	33.6	27	89	63	0.6	4.9	6.2	6.3
4	34	35	27	90	66	0.8	4.6	7.2	6.5
5	35	35.5	26.5	91	65	1.1	4.5	5.7	6.9
6	36	36.5	25.6	92	68	8.9	3.9	5.6	7.1
7	37	37.5	23.5	93	64	29.2	5.2	6.9	7.6
8	38	33.7	23.3	95	75	44.6	2.9	5.9	6.6
9	39	36.8	21.6	96	69	32	2.6	3.6	7.1
10	40	34.6	19.3	81	28	0	2.9	2.4	8.2
11	41	35.3	18.8	89	30	0	3.1	1.7	6.8
12	42	34.7	16.2	91	25	0	2.7	1.2	7.6

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