Hexapoda (*Insecta indica*) 8

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Association of weather parameters with seasonal incidence of melon fruit flies in bitter gourd ecosystem at Varanasi

Sagnika Das[1], C.P.Srivatsava[1], S.Sithanantham[2], T.Amsa[2] and M.Prabakaran[3]

1. Department of Entomology and Agricultural Zoology, Institute of Agricultural Sciences Banaras Hindu University, Varanasi-221 005, India.
2. Sun Agro Biotech Research Centre, Chennai-600125, India.
3. Laksitha Agro Biotech, Chennai-600125, India.

ABSTRACT: In India and elsewhere in the tropics, the melonfruitfly, *Bactrocera cucurbitae* is an important insect pest on a wide range of cucurbit vegetable crops. Monitoring the seasonal pattern of population of this pest with attractant traps is reckoned as a key component of IPM. In the present studies undertaken in Varanasi,UP during 2019 Kharif season in cucurbit ecosystem, by monitoringthe weekly catches in six different trap-dispenser combinations with cue-lure as attractant, there was significant correlation with wind speed, which is also in conformity with earlier findings on the role of wind in dynamics of fruit flies. There was, nevertheless, lack of significant correlation with four other weather parameters studied. The Results indicated the scope to extend the study to capture the differential extent of correlation among key weather parameters with variations in time and space to evolve more robust short term prediction of the seasonal population pattern of fruit flies based on traps kept for monitoring in cucurbit crop ecosystem, for timely management of the pest.

Key words: *Bactrocera cucurbitae*, trap catches, weather parameters, correlation, cucurbit ecosystem

Introduction

The melon fly *Bactrocera cucurbitae* (Coquillett) is known to damage a variety of commonly grown cucurbit vegetable crops in India, besides elsewhere in the tropics. (Dhillon *et al*., 2005). The importance of monitoring the seasonal activities of melon fly populations worldwide and the use of pheromone traps as

*Author for correspondence. Email:

an easy and efficient approach for their eco-safe managment has been well documented. (Alyokhin *et al.*, 2000). Cue-lure attractant traps have been used for monitoring the melon fly males in bitter gourd as among other cucurbit crops (Vargas *et al*., 2010).Correlation of the seasonal population fluctuation in fruit fly species with the abiotic factors like, temperature, humidity, rainfall, etc., besides biotic factors can lead to reliable short term early warning strategy. Such approach has shown potential elsewhere as reported by Shivayya and Kumar (2008) that *B. cucurbitae* population on bitter gourd was found to be significantly correlated with local maximum temperature, rainfall, and average relative humidity. The present studies were taken up to derive such information in cucurbit ecosystem around Varanasi in Uttar Pradesh. The results are discussed in the context of their potential use in IPM development.

Materials & Methods

The field study was carried out in a farmer cucurbit crop field near Varanasi during 2018-19 *kharif* season. Three types of traps all with Cue-lure as attractant were kept for the seasonal monitoring of the melon fly catches. The three trap types namely Delta small trap, Foldable trap and Cylindrical trap were kept in combination with two different size dispenser disc (4x4x1cm and 4x1x1cm, respectively) which were fully charged with cue-lure as provided by M/S Sun Agro Biotech Research Centre, Chennai, were installed in the field. These six combinations of traps-dispensers were installed in randomized block design in four replications. These traps were inspected weekly to record the melon fly catches individually in each trap. The traps were also interchanged in their positions at random within each replication in every week to avoid position effect on the trap catches. Such recording of catches was also taken in six successive weekly intervals.

Related agro-meteorological data *viz*. minimum and maximum temperature, morning and evening percent relative humidity, total rainfall were collected for the corresponding meteorological weeks at the Meteorological Observatory, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The association of different meteorological parameters with seasonal fruit fly population as represented by overall weekly trap catches was studied with suitable statistical methodology (Gomez and Gomez,1968).

Results

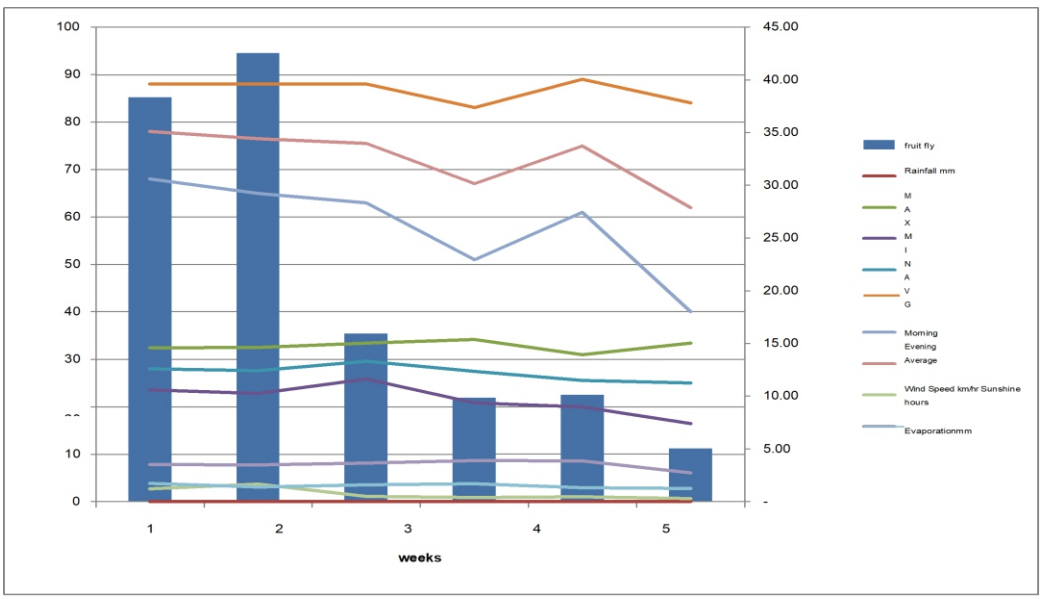
The seasonal trap catches of fruit fly in bitter gourd and their relationship with meteorological factors *viz*. temperature, relative humidity, rainfall, sunshine hours for the study period 37th SW to 42nd SW, 2018 were analysed. The correlation between fruit fly trap catches and the abiotic environmental factors like temperature ^{0}C (maximum and minimum), relative humidity (%) (maximum and minimum), rainfall mm, sunshine (hrs), evaporation (mm), wind speed (km/hr) was assessed as per standard methodology .The number of fruit flies trapped at weekly intervals (Table 1 and Figure 1.I) revealed that the mean fruit fly catch during the first week(37th SW) was 38.38 (fruit flies/traps/week). During this period the highest and least temperatures were 32.5^{0}C and 23.6^{0}C respectively, while morning and night relative humidity was 88% and 65%. There was 53.4 mm precipitation, wind speed was 3.7 Km/hr, sunshine 7.7hrand evaporation 3.1mm.

Table1: Effect of weather parameters on incidence of fruit fly during *Kharif* 2018-19

			Rainfall mm	Temperature ^{0}C			R.H. %			Wind	Sunshine hours	Evaporation mm
SW	Month & Date	Fruit fly trap catch		Max	Min	Avg	Morning	Evening	Average	Speed km/hr		
1st -37	Sep 10 -16	38.3	0	32.4	23.6	28.0	88	68	78	2.7	7.8	3.8
2nd -38	17-23	42.5	53.4	32.5	22.8	27.6	88	65	76	3.7	7.7	3.1
3rd -39	24-30	15.9	0	33.4	25.9	29.6	88	63	75	1.1	8.1	3.5
4th -40	Oct 01-7	9.8	0	34.2	20.8	27.5	83	51	67	0.8	8.6	3.7
5th-41	08-14	10.1	0	31.0	20.0	25.5	89	61	75	1	8.5	2.9
6th -42	15-21	5.0	0	33.4	16.5	24.9	84	40	62	0.6	6.1	2.8

Note: SW : Standard Week ; Max : Maximum; Min : Minimum; Avg : Average; R.H: Relative Humidity

Fig.1. Correlation between weekly melon fly trap catches and weather parameters



During the second week (38 SW) the trap catch was 42.5 fruit flies/week, with maximum and minimum temperature of 32.5 and 22.8^{0}C averaging 27.6^{0}C, the relative humidity during maximum and minimum at 88 and 65% with average 76%. The rainfall was 53.4mm with windspeed of 3.7km/h, and 7.7 hrs of sunshine and evaporation rate of 3.1mm.

During the third week (39SW) there was decrease in trap catch(15.92 flies/traps/week),which coincided with maximum and minimum temperature being 33.4^{0}C and 25.9^{0}C respectively. The

respective morning and evening relative humidity was 88% and 63% averaging 75%.With rainfall of 53.4 mm, and wind speed of 1.1Km/hr, the sun shine was 8.1hr and evaporation at 3.5mm.

In the fourth week(40SW) there appeared to be further decline in the mean fruit fly catches (9.83 flies/traps/week),which coincided with maximum and minimum temperature of 34.2^0 C and 20.8^0 C respectively, whereas morning and evening relative humidity was 83% and 51% respectively, while there was no rainfall during this week.

During the penultimate week,(41 SW) there was little increase in mean catch of fruit flies (10.13 fruit flies/traps/week).During this period maximum and minimum temperature were 31^{0}C and 20^{0}C respectively, with morning and evening relative humidity being 89% and 61% respectively. There was no rainfall, the wind speed was 1Km/hr, sunshine 8.5hr, and evaporation at 2.9 mm.

In the last week (42 SW), the fruit fly catches steeply declined to 5.04 fruit flies/traps/week. The corresponding maximum and minimum temperature were 33.4^{0}C and 16.5^{0}C respectively, while the respective morning and evening relative humidity was 84% and 40%. With no rainfall, wind speed was 0.6Km/hr, sunshine 6.1hr and evaporation at 2.8 mm.

It is seen from Table.2, that the maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, besides rainfall, sunshine and evaporation-all had a non-significant correlation with fruit fly catches. Whereas correlation coefficient values showed a strong positive correlation with the wind speed (0.980**).

Table 2: Correlation co-efficient between weather parameters and fruit fly catches in traps on bitter gourd crop during *Kharif* 2018- 19

Dependent. .Variable	Rainfall in mm	Temperature ^{0}C			R.H. %			Wind	Sunshine hours	Evaporation mm
		MAX	MIN	AVG	Morning	Evening	Average	Speed km/hr		
Fruit fly trap catch	0.679^{NS}	-0.247^{NS}	0.560^{NS}	0.450^{NS}	0.514^{NS}	0.747^{NS}	0.722^{NS}	0.980**	0.095^{NS}	0.330^{NS}

NS :Non significant ** Highly Significant

Discussion

Our results on correlation between trap catches and weather parameters showed that there was strong positive correlation with wind speed, while no significant correlation could be found with the other weather parameters. It is significant that our present results are in conformity with the positive role of wind speed in fruit fly population changes as reported by Whitehead *et.al*., (2015) based on the detailed behavioural response of fruit flies to changes in wind.

Our present results on minimum temperature and relative humidity were non-significant in correlation are also on similar lines to the report of Bhowmik *et al*., (2014) that in both years there was such non-significant correlation, The possible reasons for inconsistency in non-significant correlation between fruitfly trap catches versus minimum temperature or relative humidity in relations to results

from other workers mentioned hereafter, could be based on interrelationship between relative humidity and rainfall. For instance , besides similar non-significant association with rainfall in one of the two years in studies in same crop ecosystem in West Bengal. Similar to our results, consistent non-significant correlation between relative humidity and rainfall was also evident among all three locations studied in Karnataka by Abilash. *et.al., (*2017). Our results are also in agreement with the non-significant association of humidity by Alim. *et.al.,*(2012) who found no correlation between air humidity and *B.cucurbitae*, populations.

It should be pointed out that in our present and other related published studies, the extent to which there could be variations in the correlation over time and space should be taken into account, as mentioned also by Aftab Hossain *et. al*.,(2019).

There is good scope for present studies to be further extended to evolve more robust prediction of fruitfly trap catches weather-based software program to guide our multitude of cucurbit crop farmers.

Conclusion

The outcome of the present studies, while confirming the role of windspeed as a weather parameter in population monitoring in cucurbit ecosystem in the target region, point to the scope to be further extended to evolve more robust prediction capacity forfruitfly trap catches with weather-based software program to guide our cucurbit crop farmers.

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