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Original Research Article

Influence of Weather Factors on Fluctuation of *Pyrilla perpusilla* Walker Population in Sugarcane

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A B S T R A C T

In order to determine the role of weather factors viz., maximum, minimum temperature (^{0}C), relative humidity (%) at 07 hrs. and 14 hrs. and rainfall (mm) in fluctuating *Pyrilla perpusilla* Walker population, a field experiment was conducted at Pusa Farm, Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa – 848125 Samastipur (Bihar). The experiment was during cropping season of 2016-17 with midlate variety BO 91 planted in the month of February, 2016 in 0.5 hectare. The severe occurrence of egg, nymph and adult population of pyrilla were observed in August, 2016 and their peak being 6.6 egg masses, 5.3 nymphs and 21adults/leaf of sugarcane when corresponding weather parameters viz. maximum and minimum temperature (^{0}C), relative humidity (%) at 07 hrs. and 14 hrs. and rainfall (mm) were 34, 24.2, 85, 65 and 3.4, respectively. It indicates from the results that the temperature (maximum and minimum) showed significant positive correlation with population of egg masses, nymphs and adults, while relative humidity showed (07 hrs.) negative correlation but statistically was non-significant with egg masses and nymphs except adults. However, relative humidity (14 hrs.) and rainfall exhibited positive relation but statistically was non-significant. The data revealed that the weather parameters governed together 94.77, 73.66 and 81.28 per cent towards egg masses, nymphs and adults population respectively. It is clearly indicated that the temperature (maximum and minimum) was the congenial weather element for build-up pyrilla population in sugarcane. Remaining factors (relative humidity and rainfall) had positive relation but statistically was non-significant except egg masses and nymph which were showed negative correlation with relative humidity at 07 hrs.

Keywords

Weather factors, Fluctuation, *Pyrilla perpusilla* and Sugarcane

Introduction

Sugarcane crop is of great importance in the agricultural sector and in general economy of many of the tropical developing countries. Due to its wide range of adaptability, it supplies more than 60 per cent of the world sugar. It is grown under varied soil and climatic conditions, but its productivity is generally limited by abiotic and biotic stresses as it has to face vagaries of nature all the year around in the field.

The various factors responsible for low yield of sugarcane, insect pests are the major concern. Among insect pests, *Pyrilla perpusilla* is a serious pest of the sugarcane and its stages, nymph and adult feed on it by sucking the cell-sap, which extensively affects its production (Kumar and Yadav, 2006). Temperatur above 40^{0}C and a relative humidity less than 50 per cent, along with westerly wind will drastically reduce

the population of pyrilla. Outbreak of pyrilla was noticed during March - June, 2007 on sugarcane as well as wheat, jowar, maize, and berseem. Weeds like *Saccharum* spp., *Sorghum helepense*, etc. were found harbouring pyrilla. About 40,000 ha area of sugarcane was infested by pyrilla in three sugarcane mill zones (Gangwar *et al.*, 2008). Chand *et al.,* (2016) reported that the mean mortality of Pyrilla in 1, 3, 7 and 14 days after spraying, imidacloprid-17.8 SL @ 0.5 ml/litre of water proved significantly effective.

According to Ganehiarachchi and Fernando (2000) pyrilla abundance is negatively correlated with rainfall and humidity but positively with minimum temperature. Keeping in view present study is being proposed to conduct the influence of weather factors on fluctuation of *Pyrilla perpusilla* population in sugarcane under Bihar agro ecosystem.

Materials and Methods

In order to determine the role of weather factors viz., minimum, maximum temperature (0C), relative humidity (%) at 07 hrs. and 14 hrs. rainfall (mm) in the fluctuating *Pyrilla perpusilla* Walker pest population. A field experiment was carried out with mid late sugarcane variety (BO 91) was planted in 0.5 acre on February 5, 2016 at Pusa Farm Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University as per recommended package of practices of the University for production of sugarcane, keeping them completely free from insecticidal contamination. The observations were recorded at fortnightly interval from ten randomly selected leaves at top, middle and lower portion of plant at three different locations for March, 2016 to February, 2017. Correlations of various weather factors temperature (^{0}C), relative humidity (%) and rainfall (mm) with the fluctuation of pest-population were worked out also.

Results and Discussion

The absolute population of egg masses, nymphs and adults were estimated by counting the number of population on 10 randomly selected leaves at three different locations at fortnightly interval starting from March, 2016 to February, 2017. The data is presented in Table 1 to 2(a). The data reveals from the table that the population of the egg masses initiated to build up from the first fortnight of April, 2016 (60 days after the planting of setts) which was ranged from 0.3 to 6.6 per leaf. It was also indicated from the data that the peak (6.6 egg masses/leaf) was observed in second fortnight of August, 2016, when corresponding weather parameters viz. maximum and minimum temperature (^{0}C), relative humidity (per cent) at 07 hrs and 14 hrs and rainfall (mm) were 34, 24.2, 85, 65 and 3.4, respectively.

Egg masses of pyrilla population declined during rainy season. It was also seen that egg masses of pyrilla did not tolerate heavy rains. However the peak population of egg masses in the experimental plot was reflected in the first, fortnight of August, 2016. The temperature (maximum and minimum) prevailing in rainy months, (from June to August) was found unfavourable for the pest.

In case of nymph population it started to build up from the first fortnight of March, 2016 i.e. 30 days after the planting of setts. The population of nymphs ranged from 0.1 to 5.3 per leaf during course of investigation. The perusal of data indicated that the peak (5.3 nymphs/leaf) was observed in the second fortnight of August 2016, when corresponding weather

parameters, viz. maximum, minimum temperature (^{0}C), relative humidity (%) at 07 hrs. and 14 hrs. and rainfall (mm) were 34, 24.2, 85, 65 and 3.4, respectively. Nymphs of pyrilla population declined during rainy season. The peak population of nymphs in the experimental plot was reflected in August, 2016.

The data reveals that the population of adults started to build up from the second fortnight of March to second fortnight of November and the population of adults ranged from 0.2 to 21 per leaf. The data indicated that the peak (21adults/leaf) was in the first fortnight of August, 2016, when corresponding weather parameters, viz. maximum, minimum temperature (^{0}C), relative humidity (per cent) at 07 hrs. & 14 hrs and rainfall (mm) were 34, 24.2, 85, 65 and 3.4, respectively. The peak population of adult in the experimental plot was reflected from June to August, 2016 thereafter declined trend was observed.

Table.1 Role of weather factors on *Pyrilla perpusilla* population fluctuating in sugarcane

Months		Av. No. of population/leaf			Temperature (^{0}C)		Humidity (%)		Rainfall (mm)
		Egg masses	Nymph	Adult	Max.	Min.	07 hrs	14 hrs	
March, 2016	I	0	1.3	0	29.1	16.9	85	47	2.0
	I I	0.2	0.9	0	33.7	17.1	80	34	3.6
April, 2016	I	0.7	0.7	0.3	37.2	21.2	69	30	3.2
	I I	5.2	4.2	2.5	39.3	22.2	73	28	0
May, 2016	I	2.1	3.1	2.3	35.2	23.4	83	50	65.2
	I I	1.6	2.7	2.0	33.8	22.7	83	56	67.6
June, 2016	I	15.2	3.6	5.6	36.2	26.2	80	55	28.4
	I I	12.3	3.0	5.3	34.2	26.2	87	67	76.7
July, 2016	I	12.0	2.2	4.2	32.9	26.4	89	73	100.6
	I I	15.3	0.8	0.7	30.9	23.9	92	84	203.5
August, 2016	I	21.0	3.1	4.2	33.4	26.3	87	68	107.4
	I I	14.2	5.3	6.6	34.0	24.2	85	65	3.4
September, 2016	I	11.3	1.8	1.5	31.9	25.8	93	79	170.4
	I I	13.1	2.6	2.1	30.8	23.2	92	78	148.8
October, 2016	I	16.3	2.9	5.3	33.1	23.9	90	67	34.6
	I I	9.6	1.3	6.2	39.1	21.8	86	48	0
November, 2016	I	3.1	0.3	1.4	30.9	18.2	85	39	0 0
	I I	0.6	0.1	0.3	27.2	13.6	87	49	0
December, 2016	I	0	0	0	23.2	11.3	88	63	0
	I I	0	0	0	21.3	11.2	92	67	0
January, 2017	I	0	0	0	20.8	8.2	93	60	0
	I I	0	0	0	24.1	9.1	93	65	0
February, 2017	I	0	0	0	23.8	10.2	92	61	0
	I I	0	0	0	27.9	11.5	87	55	0

Table.2 Correlation matrix: Role of weather factors on *Pyrilla perpusilla* population fluctuating in sugarcane

No. of observation	Population	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)
		Maximum	Minimum	07 hrs	14 hrs	
24	Egg masses	0.644**	0.733**	-0.109	0.165	0.153
	Nymph	0.691**	0.784**	-0.324	0.054	0.254
	Adult	0.539**	0.760**	0.090	0.381	0.433

** Significant at 1 % probability level.

Table.2 (a) Multiple linear regression models for role of weather factors on *Pyrilla perpusilla* population fluctuating in sugarcane

No. of observation	Population	Pure constant	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm) (X_5)	R^2
			Maximum (X_1)	Minimum (X_2)	07 hrs (X_3)	14 hrs (X_4)		
24	Egg masses (Y1)	-29.470	0.289 (3.493)	0.308 (4.223)	0.141 (2.753)	0.107 (4.049)	-0.041 (10.765)	0.9477
24	Nymph (Y2)	-0.806	0.006 (0.051)	0.248 (2.233)	-0.056 (-0.723)	0.052 (1.294)	-0.016 (-2.721)	0.7366
24	Adult (Y3)	-85.359	0.560 (1.207)	0.935 (2.277)	0.570 (1.977)	0.180 (1.210)	-0.068 (-3.206)	0.8128

Figure in parenthesis indicate't' value.

Multiple linear regression equation

$Y1 = -29.470 - 0.289(X_1) + 0.308(X_2) + 0.141(X_3) + 0.107(X_4) - 1.041(X_5)$
$Y2 = -0.806 + 0.006(X_1) + 0.248(X_2) - 0.056(X_3) + 0.052(X_4) - 0.016(X_5)$
$Y3 = -85.359 + 0.560(X_1) + 0.935(X_2) - 0.570(X_3) + 0.180(X_4) - 0.068(X_5)$

Correlation Coefficient

The correlation analysis between weather factors and the population of egg masses, nymphs and adults are summarized in Table 2. The data clearly indicated that temperature ^{0}C (maximum and minimum) showed highly significant positive correlation with population of egg masses, nymphs and adults being r = 0.644, r = 0.733; r = 0.691, r = 0.784 and r = 0.539, r = 0.760, respectively. While relative humidity showed (07 hrs.) negative correlation but non-significant being r = -0.109 and r = -0.324 with egg masses and nymphs, respectively except adults (r = 0.090). However, relative humidity (14 hrs.) and rainfall exhibited positive relation but statistically was non-significant. Multiple linear regressions were worked by taking pyrilla population of egg masses, nymphs and adults as dependant variable and climatic factors as independent variables (Table 2a). The data revealed that weather parameters governed together 94.77, 73.66 and 81.28 per cent towards egg masses, nymphs and adults population, respectively (R^2 = 0.9477, 0.7366 and 0.8128). It is clearly indicated that high temperature ^{0}C (maximum and minimum) was the congenial weather element for build-up pyrilla population.

The present findings is in close conformity with the result of Ganehiarachachi and Fernando (2000), revealed that the sugarcane leaf hopper, *Pyrilla perpusilla*, the number of egg masses, nymphs and adults, were high in July, August to October 1993, April to September 1994 and February to March 1995.

Gulati (2004) reported significant correlation with mean temperature, significant negative correlation with mean RH and non-significant negative correlation with rainfall of *Tetranychus neocaledonicus* on Okra.

The present finding are more or less similar to the report of Hugar *et al.*, (2002) they observed that the peak of egg masses population during the second fortnight of September, with 4.1 egg masses, 26.1 nymphs and 22.1 adults per clump.

The interactions between pyrilla population (egg masses, nymphs and adults) and prevailing weather parameters as obtained in present investigation provided a good support to the earlier findings of Ganehiarachachi and Fernando, (2000) who reported that the population size of *Pyrilla perpusilla* showed a negative correlation with the rainfall and humidity and a positive correlation with the minimum temperature. The main factors responsible for the fluctuation in population size of *P. perpusilla* were the egg parasitoids, predators and rainfall.

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