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Studies on the seasonal incidence of leaf footed bug, *Riptortus pedestris* (Fabricius) in field bean, *Lablab purpureus* L. and its relation with weather parameters

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Abstract
The present study was carried out to find the correlation between seasonal incidence of leaf footed bug, *Riptortus pedestris* with weather variables during *kharif* 2015-16 and *kharif* 2016-17 respectively. The data on the seasonal incidence of leaf footed bug, *R. pedestris* was recorded from third week of October during 42nd standard week to 4th standard week in *kharif* 2015 –16. The highest incidence of *R. pedestris* population was observed with two peaks *i.e.*, once at 47th standard week (3rd week of November) and second one at 49th standard week (1st week of December) with 3.5 and 3.8 bugs per plant, respectively. During *kharif* 2016-17 the highest incidence of *R. pedestris* population was recorded during 50th standard week (2nd week of December) with 3.7 bugs per plant. Correlation studies between the population of leaf footed bug, *R. pedestris* with preceding one week (one week lag) weather parameters during *kharif* 2015-16 revealed that there was a negative significant correlation with maximum temperature (-0.512*) and evaporation (-0.510*) at 5 % level of significance whereas significant positive correlation with morning relative humidity (0.071*) at 5 % level of significance. During *kharif* 2016-17, maximum temperature (-0.574*) and evaporation (-0.704**) were negatively significant with *R. pedestris* population at 5% level and 1% level of significance, respectively while morning relative humidity (0.141*) was positively significant at 5 % level of significance. Regression analysis revealed that, all weather parameters collectively influenced the *R. pedestris* bugs population to the extent of 78.16 per cent (R^2 =0.78%) on field bean.

Keywords: field bean, leaf footed bug, *R. pedestris*, seasonal incidence, correlation

1. Introduction

Pulse crops were narrated as the jewels of Indian agriculture, in view of their unique capacity to fill the dietary requirements of protein to population of rural India, besides their sustainable character through replenishing soil fertility. The Indian bean, *Lablab purpureus* (L.) Sweet. Fresh pods are acceptable and liked by all, especially during winter season under South Indian conditions and it is rich in nutritive value as it is a rich source of carbohydrates, minerals, vitamins, such as vitamin A, vitamin C, fat and fiber. The protein content of field bean is quite high varying from 20.0 to 28.0 per cent [1].

The primary cause attributed for lower yields of field bean can be due to the heavy infestation of an array of pest complex. As many as 55 species of insects and a species of mite feeding on the crop from the seedling stage to the harvest of the crop in Karnataka [2]. The Pod borers were recorded as a major problem for the low productivity in Indian condition which sometimes incur the loss to a extent of nearly 54 per cent in Indian beans [3]. The major yield loss was inflicted by the pod feeders which include both the pod borers and pod bugs. Among the sucking pests leaf footed coreid bug, *Riptortus pedestris* (Fabricius) and lablab bug, *Coptosoma cribraria* (Fabricius) occur commonly and found in large numbers throughout the cropping period [4]. The adults and nymphs of bugs infest later stages of crop growth by congregating on tender vines and sucking sap resulting in fading of vines and shoots [5, 6].

Understanding the seasonal incidence in relation with a seasonal incidence pattern of the pod borers and sucking insects will yield valuable information in strategizing the management practices. Devising effective management options is crucial in keeping the pest population below threshold level and realizing the good yields. Losses due to pod damage were estimated

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to be 11.1 to 36.4 per cent in different parts of India [7]. To know the seasonal incidence of pest population for strategizing the effective management practices the present studies have been planned.

2. Materials and Methods
To study the seasonal incidence of leaf footed bug, *R. pedestris* (Fabricius) on the
field bean crop was grown by raising 100 m² crop with a spacing of 90 x 20cm. The study was carried out during *Kharif* 2015 and 2016 in an open field located in horticulture garden, College of Agriculture, Rajendranagar, Hyderabad, PJTS Agricultural University. All the recommended routine agronomic practices except plant protection measures were followed for raising the crop. From the date of germination onwards, observations were made in the bulk plots in ten selected plants for infestation of the insects at weekly interval. The incidence of pod bugs were observed during the flowering and pod formation phase. The observations were taken on randomly selected ten plants in the bulk plot. The counts of number of pod bugs per randomly selected ten plants were recorded on the inflorescence and pods at weekly intervals. The mean of the data for each week was calculated. The status of the pest was considered based on the number of insects occurred on plants. The data obtained on the seasonal incidence of coreid bug, *R. pedestris* in field bean were subjected to correlation and multiple regression with various weather parameters *viz.*, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, rainfall, sunshine hours, evaporation *etc* [8].

3. Results and discussion
3.1 Seasonal incidence of leaf footed bug, *Riptortus pedestris* on field bean during kharif 2015-16 and 2016-17
The seasonal incidence data pertaining to the coreid bug, *R. pedestris* (Plate 1a and 1b) was collected from randomly tagged ten field bean plants at weekly intervals from an unprotected crop raised during *kharif* 2015-16 and 2016-17.

The data pertains to the mean population of leaf footed bug was collected from the germination to harvest stage of Indian bean with respect to standard meteorological weeks during *kharif* 2015-16 and 2016-17 were presented in table 3.1 and 3.2 (Figure 3.1)

Plate 1a: *Riptortus pedestris* egg mass

Plate 1b: Riptortus pedestris adult feeding on pods
Plate 1: Riptortus pedestris incidence in field bean

Table 3.1: Seasonal incidence of leaf footed bug *Riptortus pedestris* on field bean population in field bean during *kharif* 2015-16

SMW	Date of observation	*R. pedestris* bug population*	Temperature (0C)		Mean Relative Humidity (%)		Rainfall (mm)	Rainy Days	Mean Sunshine (hrs day-1)	Wind speed (km hr-1)	Mean evaporation (mm day-1)	Mean Temp (0C)
			Max.	Min.	I	II						
41	11/10/2015	0.0	33.4	19.6	88.4	37.4	0.0	0	7.9	0.1	4.5	26.5
42	18/10/2015	0.2	32.8	19.1	91.7	42.0	0.0	0	8.4	0.6	4.5	26.0
43	25/10/2015	0.6	32.4	18.1	89.3	43.6	0.0	0	8.9	1.8	4.7	25.3
44	01/11/2015	1.2	31.3	20.7	91.7	50.9	18.3	1	7.3	1.3	3.6	26.0
45	08/11/2015	1.3	31.3	17.4	90.6	73.6	0.0	0	7.3	2.3	4.4	24.3
46	15/11/2015	2.6	30.0	15.8	85.1	52.9	0.0	0	6.7	2.4	4.0	22.9
47	22/11/2015	3.5	29.4	19.1	83.0	53.9	0.8	0	6.6	1.4	3.9	24.2
48	29/11/2015	2.4	30.4	17.8	87.4	47.0	0.0	0	7.7	0.6	3.8	24.1
49	06/12/2015	3.8	29.4	14.4	91.7	36.7	1.4	0	7.0	0.4	3.5	21.9
50	13/12/2015	1.2	32.2	17.0	90.0	37.0	0.0	0	7.6	0.7	3.9	24.6
51	20/12/2015	0.8	32.4	15.7	92.9	35.3	0.0	0	8.9	0.9	4.2	24.1
52	27/12/2015	2.5	30.0	11.1	73.3	24.6	0.0	0	8.8	0.8	3.9	20.6
1	03/01/2016	1.7	30.4	11.8	84.1	26.0	0.0	0	9.6	0.9	3.9	21.1
2	10/01/2016	1.2	29.2	11.0	78.4	25.6	0.0	0	9.1	1.2	3.9	20.1
3	17/01/2016	0.6	29.1	16.6	76.6	36.4	0.0	0	6.8	1.6	3.7	22.9
4	24/01/2016	0.0	29.1	15.6	79.4	37.3	0.0	0	7.2	1.6	3.8	22.4

SMW- Standard Meteorological Week
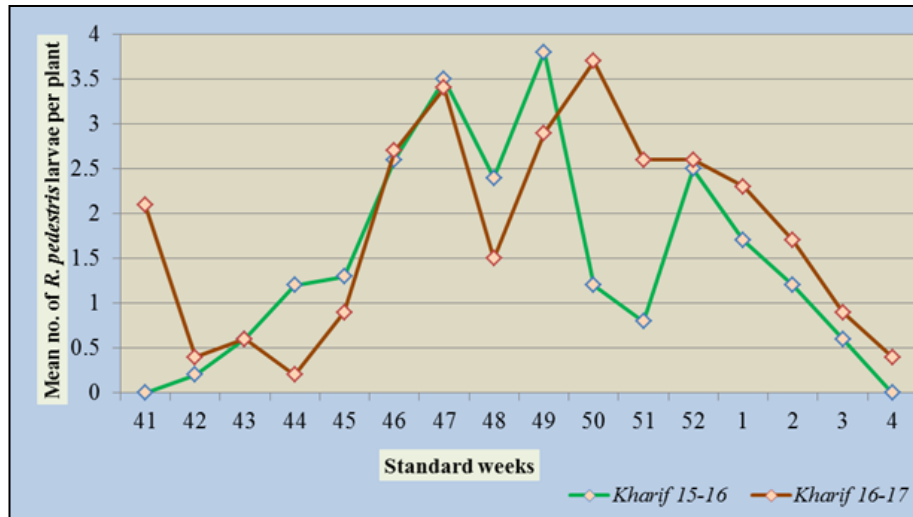*Mean no. of insects from 10 plants per plot

Fig 3.1: Seasonal incidence of *Riptortus pedestris* on field bean during *kharif* 2015-16 and 2016-17

3.1.1 Kharif 2015-16

The coreid bug, *R. pedestris* incidence on field bean was noticed from third week of October (42nd standard week) recording 0.2 bugs per plant (Table 3.1). During the 3rd week of November (47th standard week) the bug population was reached to 3.5 bugs per plant and the next peak (3.8 bugs per plant) was recorded during the first week of December (49th standard week). The bug population was reduced to a minimum (0.6 bugs per plant) by the third week of January (03rd standard week).

3.1.2 Kharif 2016-17

The incidence *of R. pedestris* on field bean was commenced from 2nd week of October (41st standard week) with a population of 2.1 bugs per plant. The population was ranged between 0.4-3.7 bugs per plant at different growth stages (Table 3.2). The peak population of *R. pedestris* (3.7 bugs /plant) was recorded during the second week of December

(50th standard week). Later the bug population was gradually decreased from the 3rd week of December (51st standard week) to the last week of January (04th standard week). The bug population was reduced to minimum (0.4 bugs/plant) by the 4th week of January (04th standard week).

The occurrence of high population of pod sucking bug, *Riptortus pedestris* and

Nezara viridula during September to December and the populations were low during January-February [9]. The incidence of *Riptortus pedestris* were observed at later stages of crop growth from November to February in field bean [10].

The two species *viz.,* R. pedestris and R. strennus incidence was commenced from August 1st fortnight to January 1st fortnight [11]. The incidence of *R. pedestris* in field bean during cropping period and noticed from the second fortnight of October and the peak infestation during the last week of October [6].

Table 3.2: Seasonal incidence of leaf footed bug, *Riptortus pedestris* on field bean population in field bean during *kharif* 2016-17

SMW	Date of observation	*R. pedestris* bug population*	Temperature (0C)		Mean Relative Humidity (%)		Rainfall (mm)	Rainy Days	Mean Sunshine (hrs day-1)	Wind speed (km hr-1)	Mean evaporation (mm day-1)	Mean Temp (0C)
			Max.	Min.	I	II						
41	11/10/2015	2.1	29.9	20.8	94.4	50.9	27.8	3	5.3	0.0	3.1	25.3
42	18/10/2015	0.4	30.6	14.6	92.7	34.1	0.0	0	9.2	0.0	4.0	22.6
43	25/10/2015	0.6	30.2	15.1	91.9	38.3	0.0	0	8.8	0.0	4.1	22.7
44	01/11/2015	0.2	30.9	19.9	84.0	47.1	0.0	0	7.0	0.0	3.6	25.4
45	08/11/2015	0.9	30.1	12.3	88.0	28.7	0.0	0	8.5	0.0	3.8	21.2
46	15/11/2015	2.7	29.8	15.7	88.7	44.9	0.0	0	6.5	0.0	3.3	22.8
47	22/11/2015	3.4	29.7	9.8	89.7	28.1	0.0	0	8.7	0.0	3.6	19.8
48	29/11/2015	1.5	30.8	10.0	90.9	31.4	0.0	0	8.3	0.0	3.3	20.4
49	06/12/2015	2.9	29.1	14.0	92.6	42.3	0.0	0	7.4	0.0	3.1	21.5
50	13/12/2015	3.7	27.9	13.1	86.3	51.3	2.0	0	6.7	0.0	3.1	20.5
51	20/12/2015	2.6	29.4	9.5	88.3	24.0	0.0	0	9.1	0.0	3.6	19.5
52	27/12/2015	2.6	29.4	8.9	91.4	31.0	0.0	0	9.0	0.0	3.5	19.2
1	03/01/2016	2.3	29.1	9.7	89.6	29.7	0.0	0	8.8	0.0	3.4	19.4
2	10/01/2016	1.7	29.3	13.2	84.0	38.0	0.0	0	7.6	0.8	3.4	21.25
3	17/01/2016	0.9	28.2	11.4	89.1	31.7	0.0	0	7.7	1.2	3.6	19.8
4	24/01/2016	0.4	29.9	14.7	85.9	38.4	0.0	0	7.6	3.0	4.3	22.3

SMW- SMW- Standard Meteorological Week
*Mean no. of insects from 10 plants per plot

3.2 Effect of abiotic factors between coreid bug, R. *pedestris* population and weather parameters during kharif 2015-16 and 2016-17

The correlation studies conducted between the R. pedesris bug population on field bean crop and weather parameters of

one week lag during *kharif* 2015-16 and 2016-17 was presented in table 3.3. Multiple Regression model developed for the population of R. *pedestris* with preceding one week weather parameters (one week lag) during *kharif* 2015-16 and 2016-17 was presented in the table 3.4.

Table 3.3: Correlation coefficients between leaf footed/ coreid bug, *Riptortus* population and weather parameters (one week lag in field bean during *Kharif* 2015-16 and *kharif* 2016-17

Weather parameters	Correlation coefficients (r)	
	Kharif 2015-16	**Kharif 2016-17**
Maximum temperature	-0.512*	-0.574*
Minimum temperature	-0.251	-0.388
Morning relative humidity (RH I %)	0.071*	0.141*
Evening relative humidity (RH II %)	0.121	0.040
Rainfall (mm)	-0.002	0.091
Rainy days (R.D)	-0.062	0.060
Sunshine hours (S.S.H)	-0.301	-0.121
Wind speed (W.S) Km/h	-0.008	-0.400
Evaporation (E. pan) (mm)	-0.510*	-0.704**
Mean temperature	-0.390	-0.475

* Significant at 5 % level
* * Significant at 1 % level

Table 3.4: Multiple regression between bug population of *R. pedistris* with weather parameters at one week lag in field bean during *kharif* 2015-16 & 2016-17

Season	Multiple regression equation	Coefficient of determination (R^2)
Kharif 2015-16	$Y = 5.71 + 2.50 X_1 + 2.90 X_2 - 0.74 X_3 + 0.91 X_4 + 10.85 X_5 -11.24 X_6 + 0.71 X_7 + 0.24 X_8 -1.24 X_9 - 3.93 X_{10}$	0.78
Kharif 2016-17	$Y = 11.95 - 5.1 X_1 - 21.16 X_2 + 0.10 X_3 + 0.23 X_4 + 1.66 X_5 -1.47 X_6 + 0.25 X_7 + 0.13 X_8 -0.77 X_9 + 22.91 X_{10}$	0.80

3.2.1 Kharif 2015-16

The correlation studies between the seasonal incidence of *R. pedestris* with the preceding one week weather parameters (one week lag) during *kharif* 2015-16 revealed that, maximum temperature (-0.512*) and evaporation (-0.510*) had a significant negative correlation (p=0.05) with the bug population of *R. pedestris*. The morning relative humidity (0.071*) had a significant positive correlation at p=0.05 level with *R. pedestris* bug population; whereas, evening relative humidity had a positive non-significant correlation (0.121) with *Riptortis* bug population. Minimum temperature (-0.251), rainfall (-0.002), rainy days (-0.062), sunshine hours (-0.301) and wind speed (-0.008) and mean temperature (-0.390) were non-significant negatively correlated with *R. pedestris* bug population (Table 3.3).

Regression analysis revealed that, all weather parameters collectively influenced the *R. pedestris* bugs population to the extent of 78.16 per cent (R^2 =0.78%) on field bean.

Studies on the multiple regression equation for *R. pedestris* bugs population with preceding one week weather parameters (one week lag) was depicted in Table 3.4 which indicated that increase in one unit of maximum temperature, minimum temperature, evening relative humidity, rainfall, mean sunshine hours and wind speed resulted in the increase of *R. pedestris* bugs population by 2.50, 2.90 0.91, 10.85, 0.71 and 0.24 units, respectively. Further, with one unit increase in morning relative humidity, rainy days, mean evaporation and mean temperature the bug population was decreased by 0.74, 11.24, 1.24 and 3.93 units, respectively in field bean (Table 3.4).

3.2.2 Kharif 2016-17

The correlation studies between the seasonal incidence of *R. pedestris* with the preceding one week weather parameters (one week lag) during *kharif* 2016-17 crop revealed that, maximum temperature (-0.574*) and evaporation (-0.704**) had a significant negative correlation at p=0.05 and p=0.01 level, respectively with the bug population of *R. pedestris*. The morning relative humidity (0.141*) had a significantly positive correlation at p=0.05 level with *R. pedestris* bug population, whereas, evening relative humidity (0.040), rainfall (0.091), rainy days (0.060) were shown positive non-significant correlation with *R. pedestris* bug population. Minimum temperature (-0.388), sunshine hours (-0.121) and wind speed (-0.400) and mean temperature (-0.475) were negatively correlated with *R. pedestris* bug population (Table 3.3).

Regression analysis revealed that, all weather parameters collectively influenced the *R. pedestris* bugs population to the extent of 80.10 per cent (R^2 =0.80%) on field bean.

Multiple regression equation was developed for *R. pedestris* bugs population with preceding one week weather parameters (one week lag) was presented in table 3.4 which indicated that increase in one unit of morning relative humidity, evening relative humidity, rainfall, mean sunshine hour, wind speed and mean temperature resulted in the increase of *R. pedestris* bugs population by 0.10, 0.23, 1.66, 0.25, 0.13 and 22.91 units, respectively. Further, with one unit increase in maximum temperature, minimum temperature, rainy days and mean evaporation the bug population decreased by 5.10, 21.16, 1.47 and 0.77 units, respectively in field bean.

The coreid bug *Riptortus pedestris* and cow bug, *Clavigralla gibbosa* were significant and negatively correlated with maximum and minimum temperature [11]. In another report the leaf footed bug, *Riptortus pedestris* showed significant positive correlation with maximum temperature [6].

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