

Influence of ambient weather on the incidence of major insect pests and their bioagents of soybean crop (*Glycine max* L. Merrill)

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ABSTRACT

Investigations were carried out during *Kharif*, 2012 at Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) on, the effect of different weather parameters on seasonal incidence of girdle beetle, lepidopterous caterpillars and sucking pests was observed. In this context, the peak activity of the girdle beetle was noticed during the first week of October which was associated with 31.9°C maximum temperature, 23.9°C minimum temperature, 91 per cent morning R.H., 56 per cent evening humidity, 9.2 mm rainfall and Sunshine hours 7.6 lux. The peak activity of total caterpillar pests (*S. litura*, *C. acuta* and *H. armigera*) was observed during third week of August with 30.2°C maximum temperature, 25.3°C minimum temperature, morning and evening R.H. 90 per cent and 78 per cent, a rainfall of 33.2 mm, respectively and sunshine hours 3.5 lux. The peak density of total sucking pests was observed during third week of August which was associated with 28.8°C maximum temperature, 24.8°C minimum temperature, morning and evening R.H. 93 per cent and 79 per cent, rainfall 106.8 mm, respectively, and sunshine hours 1.3 lux. The correlation coefficient between the predatory population and different weather parameters *viz.*, maximum and minimum temperatures, morning and evening R.H., rainfall and sunshine hours was worked out and found to be non-significant.

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INTRODUCTION

Soybean [*Glycine max*. (L.) Merrill] is an important *Kharif* crop in India. The most important products which are obtained from this crop are grains, oil, pulse, milk, curd, sweets, soya protein, neutrinugget, soya sauce etc.

Its seeds contain on an average 43.2 per cent, 19.5 per cent and 20.9 per cent protein, fat and carbohydrate contents, respectively (Singh and Mittal, 1970). But there are many problems in the cultivation of soybean in India as all stages of this crop are prone to heavy infestation

by ambient weather. Swaminathan (2011) reported the elevated ambient temperature and concentrations of greenhouse gases like CO₂, the pest species exhibit increased herbivory, longevity, voltinism, reproductive cycles, fecundity, population size, and pesticide resistance. Nyunt (2008) studied that maximum prey consumption per day and *E. furcellata* larvae was rather high, exceeding 9.65 ± 0.29 larvae at 30°C in the 5th instar of *E. furcellata*. Rai and Patel (1990) studied the incidence of the girdle beetle *Obereopsis brevis* first appeared on 10 August, 1988 (maximum and minimum temperature 29.60 and 24.70°C, respectively and R.H. 84.50%) and activity continued until 12 October, 1988. It is concluded that the low infestation level (0.86-12.09%) during the period of activity may be due to the late planting of the soybean crop and low rainfall. Prasad *et al.* (2013) reported that *Spodoptera litura* its incidence was low and delayed during, 2010, 2011 and 2012 seasons, showing inter-annual variability of rainy days. Some common weather parameter influencing soybean insect pests and their bio agents are maximum and minimum temperatures, morning and evening R.H., rainfall and sunshine hours.

MATERIAL AND METHODS

Weekly meteorological data on temperature, relative humidity, rainfall and sunshine hours were recorded during the cropping season. The incidence of major insect pests of soybean and their natural enemies was correlated with ambient weather, to find the effect of

weather on the density of insect pests and their natural enemies.

RESULTS AND DISCUSSION

The influence of different weather parameters *viz.*, maximum and minimum temperature, morning and evening relative humidity, rainfall and sunshine hours on the seasonal incidence of caterpillar pests and girdle beetle based on the number of larvae and girdle beetles infested plants in randomly selected ten one meter row lengths whereas, sucking pests and natural enemies population based on the population/plant from 20 randomly selected plants was observed by working out correlation co-efficient (r) and regression equation, $Y = a + bx$.

Girdle beetle, lepidopterous caterpillars, sucking pests and natural enemies were first observed on the crop during last week of July which was associated with 27.6°C and 24.1°C maximum and minimum temperatures, 92 and 88 per cent morning and evening relative humidity, 60.3 mm rainfall and 0.7 lux sunshine hours. Peak activity of girdle beetle (1.0 damaged plants/ m row) observed during first week of October was associated with maximum and minimum temperatures of 31.9°C and 23.9°C, morning and evening relative humidity of 91 and 56 per cent, rainfall 9.2 mm and 7.6 lux sun shine hours (Table 1). The peak activity of lepidopterous caterpillars was recorded during third week of August (3.5 damaged plants/ m row) which was associated with 30.2°C maximum and 25.3°C minimum temperature, 90 per cent

Table 1 : Total caterpillar pests (*S. litura*, *C. acuta* and *H. armigera*) on soybean crop as influenced by different weather parameters during Kharif, 2012

Sr. No.	Date of observation	No. of total caterpillar pests per meter row	Temperature (°C)		Relative humidity (%)		Rain fall (mm)	Sunshine hours (Lux)
			Max.	Min.	Morning	Evening		
1.	30.07.2012	0.3	27.6	24.1	92	88	60.3	0.7
2.	06.08.2012	0.9	25.8	23.2	95	91	271.1	0.0
3.	13.08.2012	2.2	28.8	24.8	93	79	106.8	1.3
4.	20.08.2012	3.5	30.2	25.3	90	78	33.2	3.5
5.	27.08.2012	3.1	29.6	24.5	93	78	127.6	3.1
6.	03.09.2012	1.9	31.1	25.8	92	74	55.6	4.7
7.	10.09.2012	1.4	30.3	25.1	93	75	74.4	2.5
8.	17.09.2012	1.0	30.4	24.7	93	74	42.6	4.0
9.	24.09.2012	0.6	31.4	24.6	95	73	84.4	4.3
10.	01.10.2012	0.8	32.2	24.4	90	54	2.8	8.3
11.	08.10.2012	0.6	31.9	23.9	91	56	9.2	7.6
Correlation Co-efficient (r) =			0.0003	0.527	-0.244	0.183	0.042	-0.149

Note: NS = Non-significance at 5% level (Tab. val. = 0.602 at 9 d. f.)

S = Significance at 5% level (Tab. val. = 0.602 at 9 d. f.)

morning and 78 per cent evening relative humidity 33.2 mm rainfall and 3.5 lux sunshine hours. The peak activity of sucking pests was recorded during second week of August which was associated with 28.8^o C maximum and 24.8^o C minimum temperature, 93 per cent morning and 79 per cent evening relative humidity 106.8 mm rainfall and 1.3 lux sunshine hours. The peak activity of natural enemies was recorded during last week of August which was associated with 29.6^o C maximum and 24.5^o C minimum temperature, 93 per cent morning and 78 per cent evening relative humidity, 127.6 mm rainfall and

3.1 lux sunshine hours.

There existed a significantly positive correlation between girdle beetle and temperature of the maximum with, r. value 0.637 and regression equation $y = 0.117x + (-3.268)$, $R^2 = 0.405$ (Table 2), girdle beetle and evening relative humidity having negative and significantly correlation with r. value -0.890 and regression equation was $y = 0.027x + 2.318$, $R^2 = 0.791$, Girdle beetle and sunshine hours having significantly positive correlation with, r value 0.825 and regression equation $y = 0.111x + (-0.169)$, $R^2 = 0.680$ (Fig.1, 2 and 3).

Table 2 : Seasonal Incidence of girdle beetle (*O. brevis*) as influenced by different weather parameters on soybean crop during Kharif, 2012

Sr. No.	Date of observation	No. of plants infested by girdle beetle per meter row	Temperature (^o C)		Relative humidity (%)		Rainfall (mm)	Sunshine hours (Lux)
			Max.	Min.	Morning	Evening		
1.	30.07.2012	0.0	27.6	24.1	92	88	60.3	0.7
2.	06.08.2012	0.0	25.8	23.2	95	91	271.1	0
3.	13.08.2012	0.0	28.8	24.8	93	79	106.8	1.3
4.	20.08.2012	0.0	30.2	25.3	9	78	33.2	3.5
5.	27.08.2012	0.0	29.6	24.5	93	78	127.6	3.1
6.	03.09.2012	0.0	31.1	25.8	92	74	55.6	4.7
7.	10.09.2012	0.3	30.3	25.1	93	75	74.4	2.5
8.	17.09.2012	0.3	30.4	24.7	93	74	42.6	4
9.	24.09.2012	0.2	31.4	24.6	95	73	84.4	4.3
10.	01.10.2012	0.8	32.2	24.4	90	54	2.8	8.3
11.	08.10.2012	1.0	31.9	23.9	91	56	9.2	7.6
Correlation co-efficient (r) =			0.637*	-0.254	0.186	-0.890**	-0.541	0.825**

Note: NS = Non-significance at 5% level (Tab. val. = 0.602 at 9 d. f.)

*S = Significance at 5% level (Tab. val. = 0.602 at 9 d. f.)

**HS = Highly Significance at 1% level (Tab. val. = 0.735 at 9 d. f.)

Table 3 : Total sucking pests (*B. tabaci* and *E. kerri*) as influenced by different weather parameters on soybean during Kharif, 2012

Sr. No.	Date of observation	No. of total sucking pests per plant	Temperature (^o C)		Relative humidity (%)		Rainfall (mm)	Sunshine hours (Lux)
			Max.	Min.	Morning	Evening		
1.	30.07.2012	0.1	27.6	24.1	92	88	60.3	0.7
2.	06.08.2012	1.9	25.8	23.2	95	91	271.1	0.0
3.	13.08.2012	6.5	28.8	24.8	93	79	106.8	1.3
4.	20.08.2012	5.6	30.2	25.3	90	78	33.2	3.5
5.	27.08.2012	6.2	29.6	24.5	93	78	127.6	3.1
6.	03.09.2012	5.9	31.1	25.8	92	74	55.6	4.7
7.	10.09.2012	4.7	30.3	25.1	93	75	74.4	2.5
8.	17.09.2012	5.4	30.4	24.7	93	74	42.6	4.0
9.	24.09.2012	3.0	31.4	24.6	95	73	84.4	4.3
10.	01.10.2012	3.9	32.2	24.4	90	54	2.8	8.3
11.	08.10.2012	1.0	31.9	23.9	91	56	9.2	7.6
Correlation co-efficient (r) =			0.239	0.714*	-0.069	-0.020	-0.069	0.010

Note: NS = Non-significance at 5% level (Tab. val. = 0.602 at 9 d. f.)

*S = Significance at 5% level (Tab. val. = 0.602 at 9 d. f.)

Similarly, total sucking pests was significantly positively co-related with minimum temperature having, r. value 0.714 and regression equation $y=2.247x + (-51.22)$, $R^2= 0.509$ (Fig. 4). The correlation co-efficient between the lepidopterous caterpillar and natural enemies population with different weather parameters viz, maximum and minimum temperatures, morning and evening R.H., rainfall and sunshine hours was worked out and found to be non-significant (Table 3).

Joshi and Patel (2010) also observed non-significant

relationship between the insect pest population and the ambient weather.

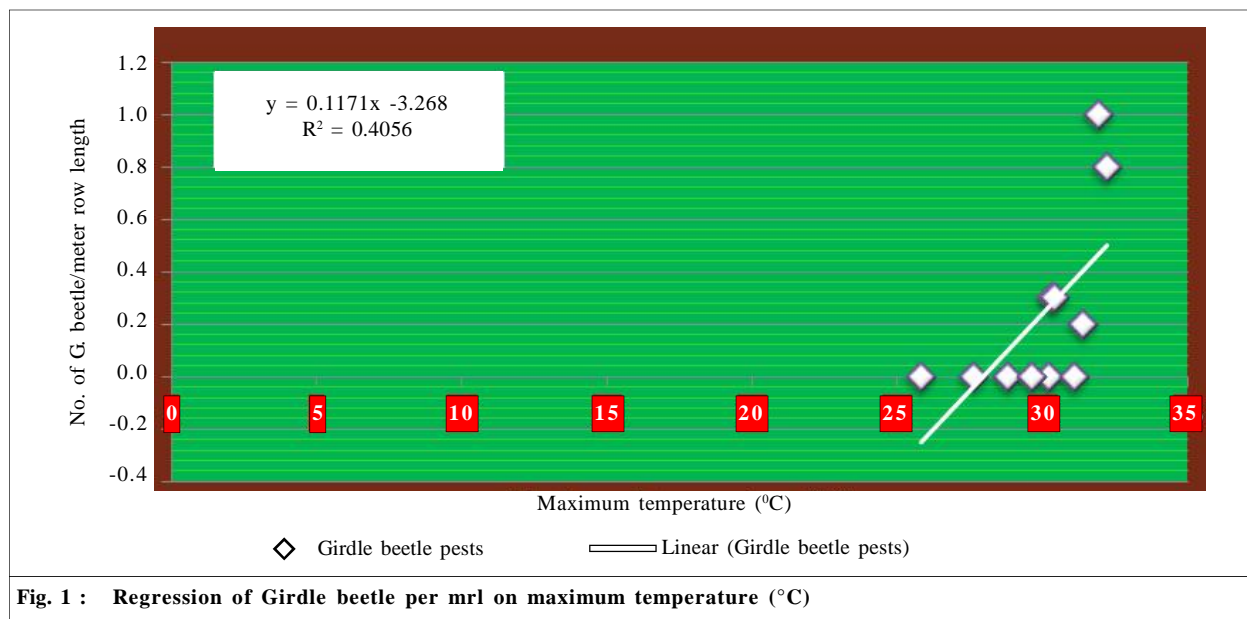
El-Khouly *et al.* (1998) studied the combined effect of the weekly mean of predator populations, daily mean temperature, relative humidity and wind speed. It was responsible for 84.76, 73.9, 68.70 and 58 per cent of changes in the populations of jassids, thrips, whitefly and aphids, respectively, in the first season, and for 79.40, 54.80, 66.30 and 45.8 per cent, respectively, in the second season.

Table 4 : Total natural enemies (C. beetle, Pentatomid bug and Spider) on soybean crop as influenced by different weather parameters during Kharif, 2012

Sr. No.	Date of observation	Total no. of predators per plant	Temperature (⁰ C)		Relative humidity (%)		Rainfall (mm.)	Sun shine hours (Lux)
			Max.	Min.	Morning	Evening		
1.	30.07.2012	0.1	27.6	24.1	92	88	60.3	0.7
2.	06.08.2012	0.9	25.8	23.2	95	91	271.1	0.0
3.	13.08.2012	1.8	28.8	24.8	93	79	106.8	1.3
4.	20.08.2012	1.8	30.2	25.3	90	78	33.2	3.5
5.	27.08.2012	2.6	29.6	24.5	93	78	127.6	3.1
6.	03.09.2012	1.6	31.1	25.8	92	74	55.6	4.7
7.	10.09.2012	1.7	30.3	25.1	93	75	74.4	2.5
8.	17.09.2012	0.6	30.4	24.7	93	74	42.6	4.0
9.	24.09.2012	0.8	31.4	24.6	95	73	84.4	4.3
10.	01.10.2012	1.0	32.2	24.4	90	54	2.8	8.3
11.	08.10.2012	1.1	31.9	23.9	91	56	9.2	7.6
Correlation co-efficient (r) =			0.145	0.438	-0.106	-0.041	0.097	0.007

Note: NS = Non-significance at 5% level (Tab. val. = 0.602 at 9 d. f.)

S = Significance at 5% level (Tab. val. = 0.602 at 9 d. f.)



Padiwal *et al.* (2007) reported that the jassid, *E. kerri*; white fly, *B. tabaci*; tobacco caterpillar, *S. litura* and grey weevil; *M. undecipustulatus* showed positive correlation with mean temperature and mean relative humidity. While, stem fly, *M. sojae* showed negative correlation with the abiotic factors.

Sutaria *et al.* (2010) studied that maximum temperature, rainfall and rainy days were negatively

correlated.

Conclusion:

The effect of different weather parameters on seasonal incidence of girdle beetle, lepidopterous caterpillars, sucking pests and natural enemies was observed. In this context, the peak activity of the girdle beetle, lepidopterous caterpillars, sucking and natural

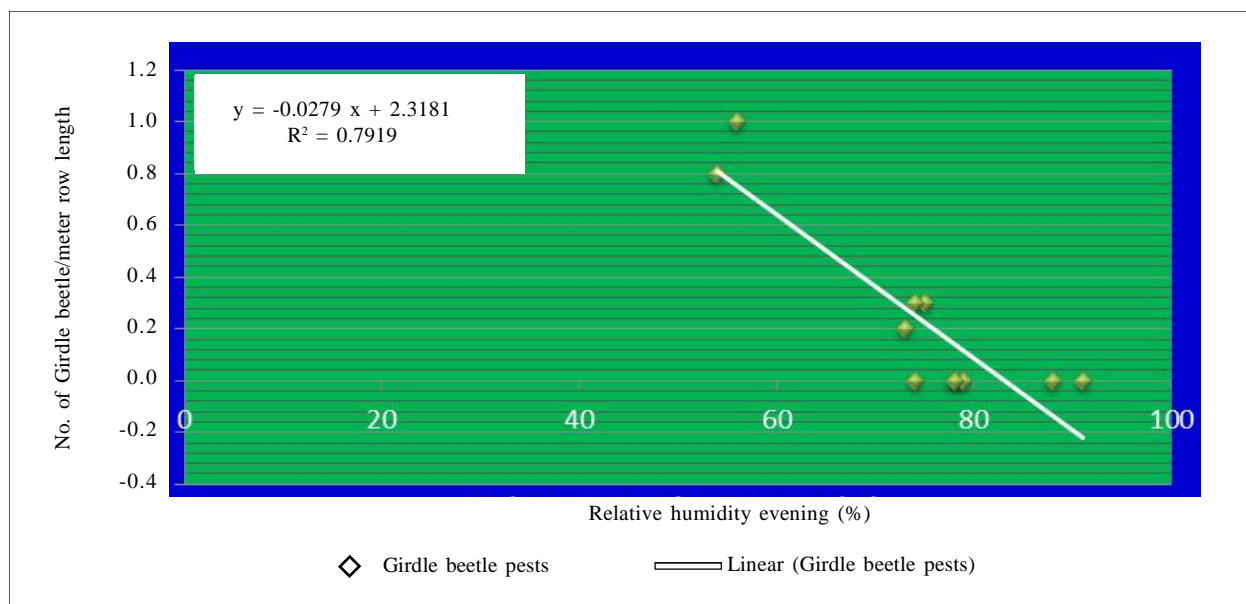


Fig. 2 : Regression of Girdle beetle per mrl on evening relative humidity (%)

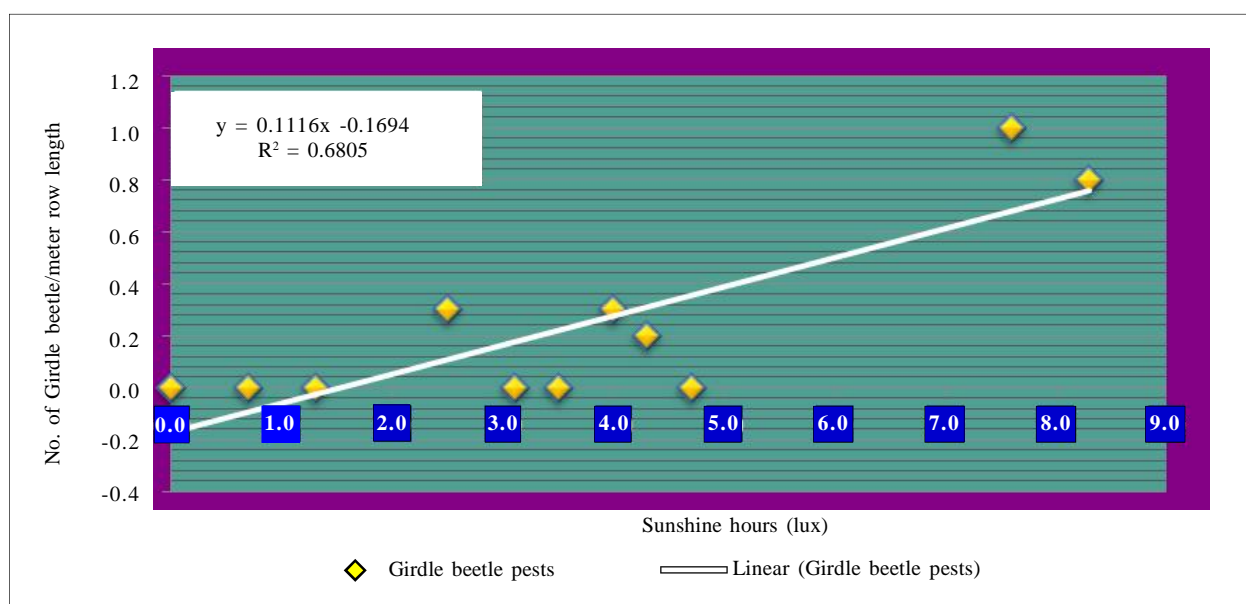


Fig. 3 : Regression of Girdle beetle per mrl on Sunshine hours (Lux)

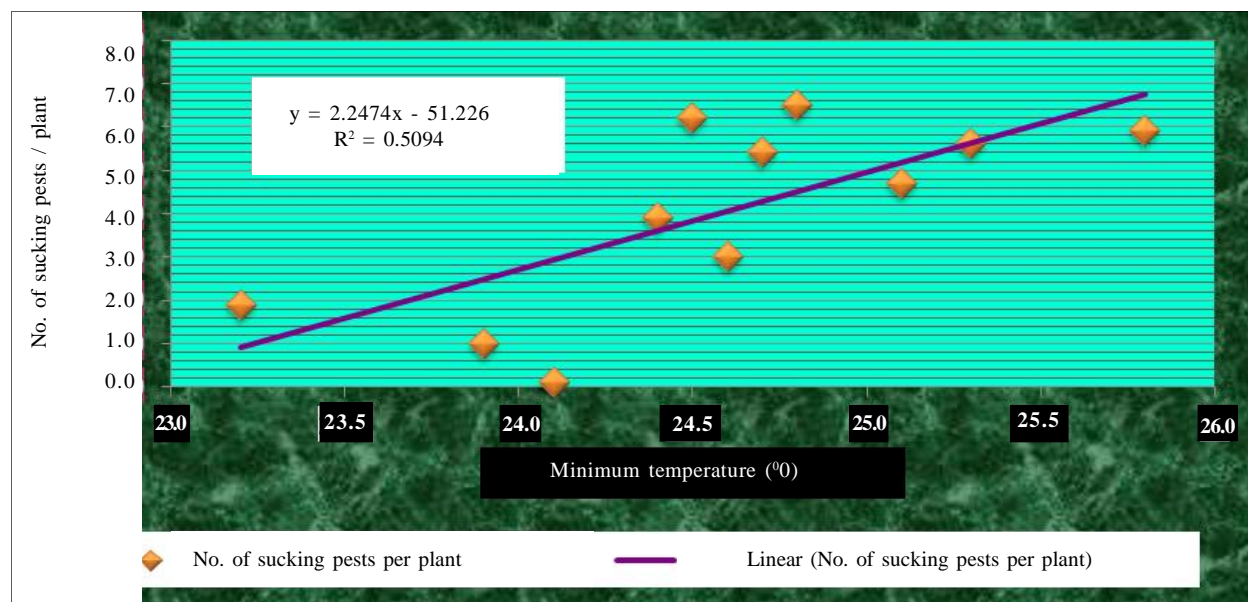


Fig. 4 : Regression of total sucking pests per plant on Minimum Temperature (°C)

enemies was noticed during the first week of October, third week of August, third week of August and last week of August, respectively, which was associated with different weather parameters viz., maximum and minimum temperature, morning and evening relative humidity, rainfall and sunshine hours. The correlation between girdle beetle and maximum temperature was a positive and significant correlation with 'r' value 0.637. The regression equation $y = 0.117x + (-3.268)$, $R^2 = 0.405$. Girdle beetle and mean Evening R.H. (%) was a negative and significant correlation with 'r' value (-0.890). The regression equation $y = 0.027x + 2.318$, $R^2 = 0.791$. Girdle beetle and sunshine hours was positive and significant correlation with 'r' value 0.825. The regression equation $y = 0.111x + (-0.169)$, $R^2 = 0.680$. The correlation between total sucking pests and minimum temperature was positive and significant correlation with 'r' value 0.714. The regression equation $y = 2.247x + (-51.22)$, $R^2 = 0.509$. The correlation co-efficient between the lepidopterous caterpillar and natural enemies population was worked out and found to be non-significant.

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