

Original Research Article

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Effect of Weather Parameter on the Population of Pink Bollworm, *Pectinophora gossypiella* (Saunders) (Lepidoptera-Gelechiidae) in Cotton

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ABSTRACT

To study the Effect of Weather parameter on the Population of Pink Bollworm, *Pectinophora gossypiella* (Saunders) (Lepidoptera –Gelechiidae) in Cotton variety JK-4 were studied consecutive two cropping seasons of Kharip. The Pink bollworm, *Pectinophora gossypiella* larvae was first recorded during the 39th SMW i.e. last week of September and remained active up to 3rd SMW i.e. IIIrd week of January, After that population showed increasing trend and attained peak during 51st SMW i.e. third week of December. The weather condition prevailed during this week viz. maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind velocity were 29.65°C, 8.74°C, 82.39%, 40.14%, 7.67 hours per day and 2.86 kmph, respectively. Further, The PBW population had a significant negative correlation with maximum temperature, minimum temperature, wind velocity, rainfall and rainy days. The multiple regression computed involving combined effect of maximum temperature (X_1), minimum temperature (X_2), morning relative humidity (X_3), evening relative humidity (X_4), sunshine hours (X_5), wind velocity (X_6), rainfall (X_7) and rainy day (X_8) was $Y=116.155-2.591X_1+0.078X_2+0.344X_3-0.161X_4-2.769X_5-8.391X_6-0.191X_7 + 10.789X_8$ ($R^2=0.899$). The Path coefficient analysis revealed that morning relative humidity had positive and high direct effect on population of PBW, followed by wind velocity, maximum temperature and rainy days respectively.

Keywords

Cotton, *Pectinophora gossypiella*, Pink bollworm, Weather, population

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Introduction

Cotton (*Gossypium hirsutum* Linnaeus) “White Gold” is one of the most important fiber, cash crops in India and plays a dominant role in agricultural economy of the country. India ranks first in the world in area and third in production (Anonymous 2002). Among various cardinal factors responsible

for poor yield of cotton in India, the damage caused by large number of insect pests during different stages of crop growth are of prime importance.

Rathod and Baporda (2006) have been estimated that about 20 to 25 percent yield losses were encountered due to the damage caused by insect pest. Dhawan, (2001)

recorded 162 insect species on cotton crop in India, of these, Pink Bollworm (PBW), *Pectinophora gossypiella* (Saunders) (Lepidoptera –Gelechiidae) is one of the most serious pest and is considered to be the major limiting factor in the successful cultivation of crop. The weather parameters play an important role both in the biology and control of the pest. In view of this, an investigation was conducted over two consecutive years to study the effect of weather parameter on pink bollworm, *Pectinophora gossypiella* (PBW) larvae.

Materials and Methods

The population dynamics of *P. gossypiella* in relation to environmental factors was assessed at the Jawaharlal Nehru Krishi Vishwa Vidyalaya, Cotton Research Station, Khandwa M.P. during kharif seasons. The Cotton, *Hirsutum* variety JK-4 was sown in observation plot of 4000 sq. m under rain fed condition in black cotton soil during the last week of June in both the years of study. All the normal agronomical practices recommended for the region were followed for raising the crop. No plant protection measure was taken throughout the crop season. The regular observations on the population dynamics of *P. gossypiella* were made at weekly intervals by randomly selected 25 plants from first appearance of pest until its cessation. At the same time, observations on meteorological parameters viz. minimum and maximum temperature, morning and evening percent relative humidity, total rainfall per week, total rainy days per week, wind velocity (kmph) and sunshine hours per day were recorded daily. Standard meteorological Week (SMW) averages of all the data collected for the pest, predator and weather parameters were calculated before statistical analysis. The data thus collected were computed and subjected to statistical analysis (Panse and Sukhatme, 1985). All the

possible correlations, multiple regression and path analysis among the environmental factors were worked out.

Results and Discussion

Population dynamics of PBW

The data of surveillance of pest presented in (Fig. 1) indicated that the pink bollworm *Pectinophora gossypiella* larvae, were first observed in the 39th SMW i.e. fifth week of September and remained active till 3rd SMW (3rd week of January). The peak population was observed (19.33 larvae / 20 bolls) during 51st SMW i.e. third week of December. The weather conditions prevailed during this week viz. maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind velocity were 29.65°C, 8.74°C, 82.39%, 40.14%, 7.67 hours per day and 2.86 kmph respectively. The present findings clearly indicated that the pest activity started from the last week of September and remained active up to January but the peak period was attained during November-December. These findings are in accordance with those reported by Kaushik *et al.*, (1969).

Simple correlation of PBW

The perusal of data (Table 1) on simple correlation studies between population of PBW and weather factors revealed that the PBW population had a significant negative correlation with max tem (R=-0.665), min tem (R=-0.736), wind velocity (R=-0.548), Rainfall (R=-0.613) and Rainy Days (R=-0.998). After 51st SMW there was a decrease in PBW population. It was estimated that every unit increase of max. tem, min tem, wind velocity, rainfall, Rainy days there is a decrease in population of PBW of 2.556, 1.009, 6.78, 0.304 and 9.48. The weather conditions prevailed during 51st SMW i.e.

third week of Dec. viz. maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind velocity were 29.65°C, 8.74°C, 82.39%, 40.14%, 7.67 hours per day and 2.86 kmph respectively. . Significantly negative correlation of PBW population with temperature was also observed by Gupta *et al.*, (1996) Chaudhari, *et al.*, (1999) and Mohapatra, *et al.*, (2004). Chaudhari, *et al.*, (1999) also reported that bollworm activity was negatively influenced by rainfall, wind speed, minimum temperature. However Bishnoi, *et al.*, (1996) observed a significant relationship between the buildup of *P. gossypiella* and the mean temperature.

Multiple regression analysis

The multiple regression computed with eight parameters i.e. maximum temperature (X₁),

minimum temperature (X₂), morning relative humidity (X₃), evening relative humidity (X₄), sunshine hours (X₅), wind velocity (X₆), rainfall (X₇) and rainy day (X₈) as independent variables and Pink bollworm population as dependent variables was as follows.

$$Y=116.155-2.591X_1+0.078X_2+0.344X_3-0.161X_4-2.769X_5-8.391X_6-0.191X_7+10.789X_8$$

(R²=0.899)

The multiple coefficient value between the pink bollworm population and group of variable clearly indicated that 89.90% change in PBW population were affected by maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours, wind velocity, rainfall and rainy day (Fig. 2).

Table.1 Simple correlation (r) and regression (Y) of pink bollworms, *P. gossypiella* larvae population with weather factors

S. No.	Character	First Year	Second year	Pooled of two year
1	T MX (°C)	r= -0.324	r= 0.828** Y=116.162-3.331X	r= -0.665** Y=90.789-2.556X
2	T MN (°C)	r= -0.543* Y=17.827-0.659	r= -0.830** Y=27.541-1.26X	r= -0.736** Y=23.558-1.009X
3	RHM (%)	r= 0.316	r= 0.542* Y=-65.07+0.939X	r= 0.460
4	RHE (%)	r= -0.190	r= -0.055	r= -0.119
5	SSH (hpd)	r= -0.329	r= -0.263	r= -0.375
6	WV (kmph)	r= -0.402	r= -0.492* =26.032-5.329X	r= -0.548* Y=29.79-6.78X
7	RF (mm)	r= -0.484* Y=9.116-0.212X	r= -0.316	r= -0.613** Y=10.024-0.304X
8	RD (dpw)	r= 0.447* Y=9.295-4.925X	r= -0.410	r= -0.998** Y=10.759-9.489X

* & ** Showed significant at 5% & 1% level of significance respectively

Table.2 Path coefficient analysis of PBW population on cotton

	T MX (°C)	T MN (°C)	RHM (%)	RHE (%)	SSH (hpd)	WV (kmph)	RF (mm)	RD (dpw)	Correlation Coefficient
T MX	0.4283	-0.6182	-0.0010	-0.0225	-0.1954	0.2307	0.0121	-0.0101	-0.1761
T MN	0.2695	-0.9824	-0.0076	-0.1963	-0.0843	0.3932	-0.0986	0.0235	-0.6830**
RHM	-0.0007	0.0123	0.6047	-0.2575	-0.0290	-0.0568	-0.0538	0.0254	0.2446
RHE	0.0177	-0.3540	0.2859	-0.5448	0.0310	0.2483	-0.0829	0.0283	-0.3707*
SSH	0.3359	-0.3327	0.0704	0.0678	-0.2490	0.0988	0.0665	-0.0221	0.0355
WV	0.1961	-0.7669	-0.0681	-0.2685	-0.0488	0.5038	-0.0886	0.0122	-0.5288**
RF	-0.0280	-0.5239	-0.1760	-0.2443	0.0895	0.2414	-0.1849	0.0501	-0.4240*
RD	-0.0629	-0.3367	0.2238	-0.2241	0.0801	0.0898	-0.1349	0.0687	-0.2960

Residual=0.5212, *& ** Showed significant at 5% & 1% level of significance respectively, The bold figures denote the direct effect of different factors on population of pest

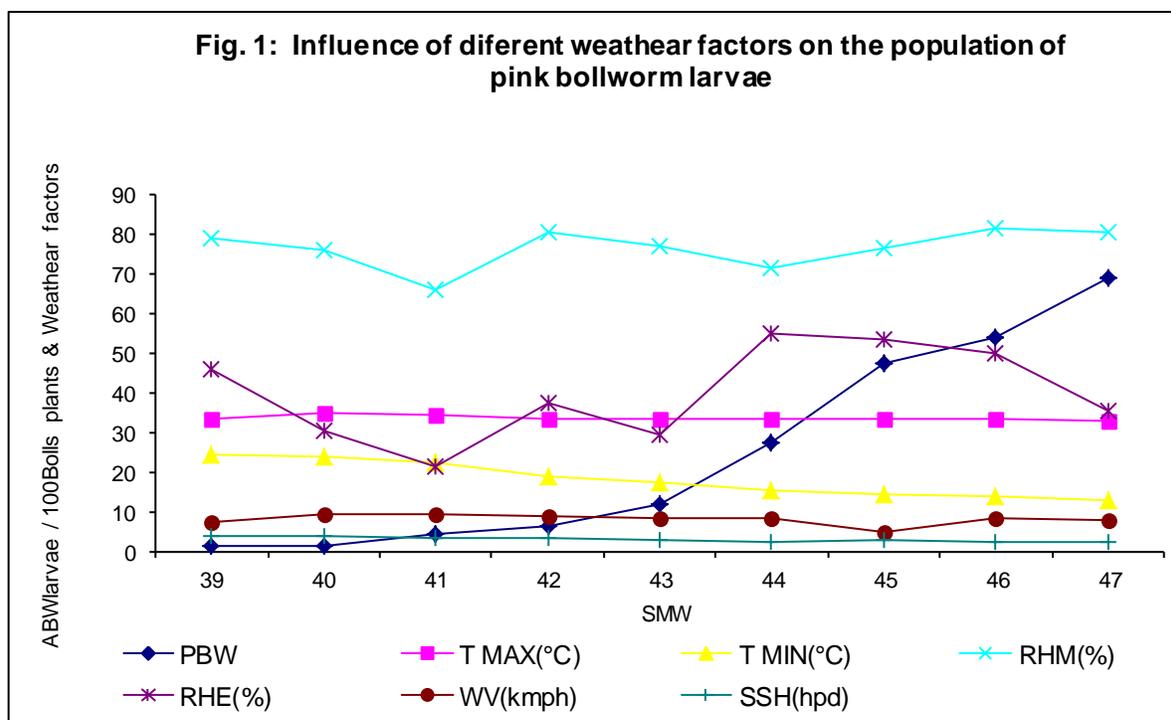


Fig.1 Influence of different weather factors on the population of pink bollworm larvae

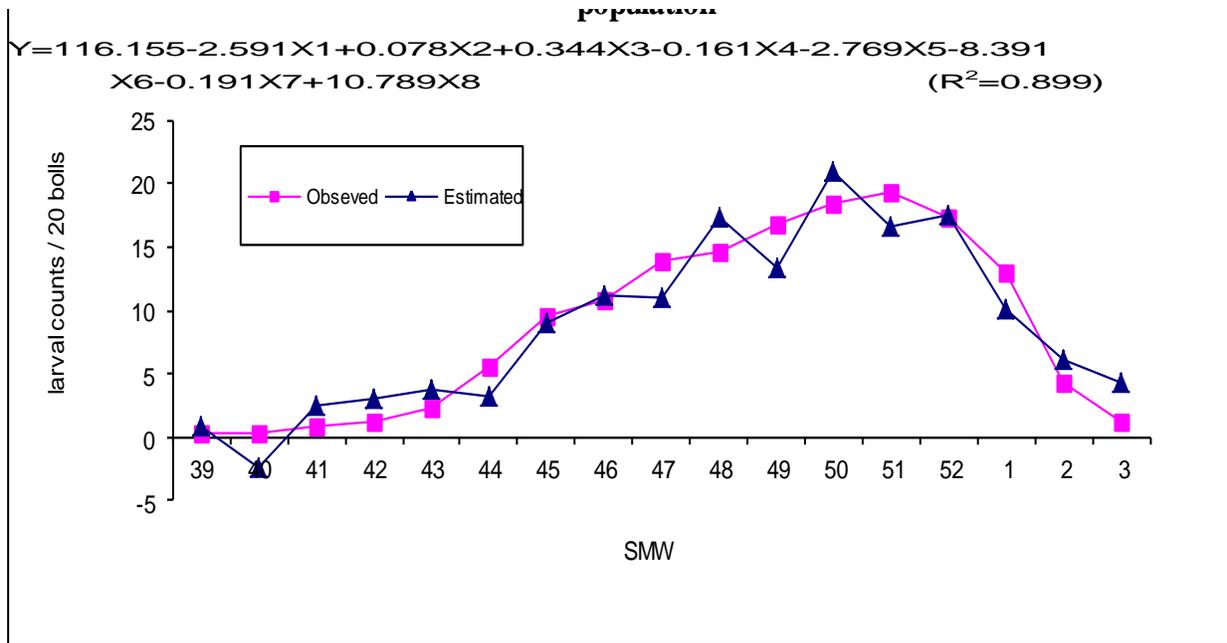


Fig.2 Multiple regression of weather factors on pink bollworm larva population

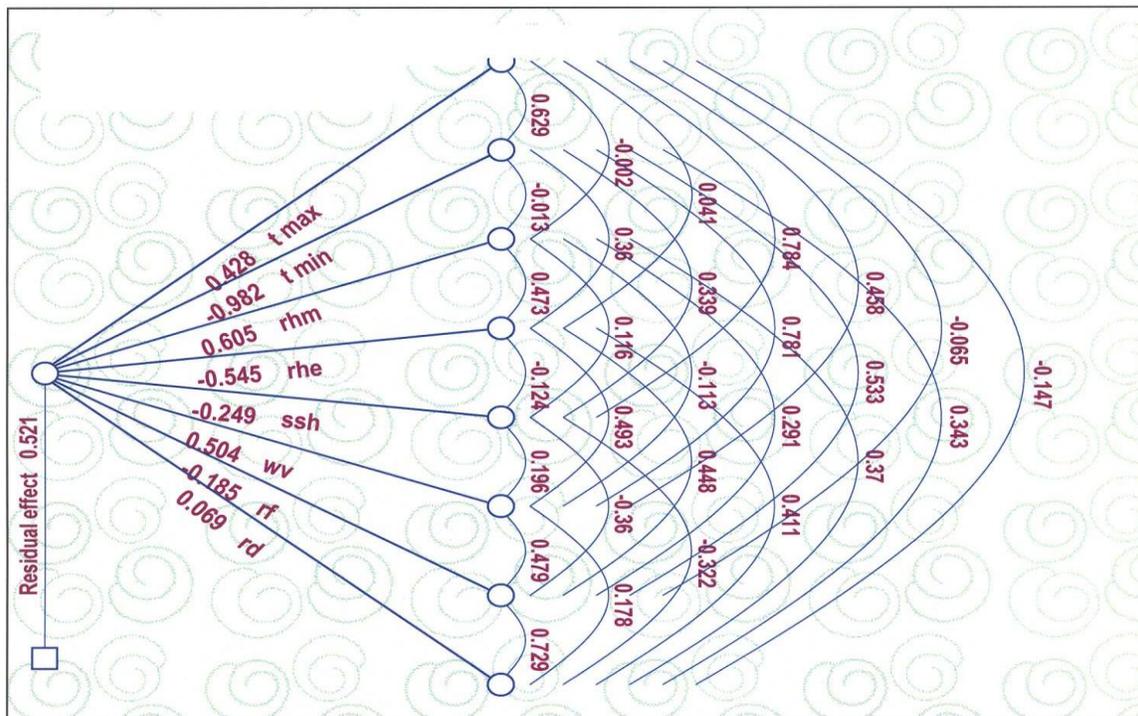


Fig.3 Phenotypical path diagram showing influence of weather factors on the population of Pink bollworms larvae

Path coefficient analysis

Path coefficient analysis of various weather parameters with PBW has been presented in

table 2 and figure 3. The weather factor exhibited significant positive correlations with PBW population were minimum temperature (-0.6830), evening relative humidity (-0.3707),

wind velocity (-0.5288) and rainfall (-0.4240) respectively.

The data revealed that morning relative humidity had positive and high direct effect (0.6047) followed by wind velocity (0.5038), maximum temperature (0.4283) and rainy days (0.0687) respectively.

Path coefficient effect revealed that the positive indirect effect of high magnitude of morning relative humidity was obtained via rainy days (0.0254) and minimum temperature (0.0123) respectively.

The positive indirect effect of wind velocity was obtained via maximum temperature (0.1961) and rainy days (0.0122). Positive indirect effect of maximum temperature was obtained via wind velocity (0.2307) and rainfall (0.0121).

Path coefficient effect revealed that the positive indirect effect of rainy days was recorded via morning relative humidity (0.2238), wind velocity (0.0898) and sun shine hours (0.0801).

On the bases of the present investigation, It can be concluded that weather parameter i. e., minimum temperature, evening relative humidity, wind velocity and rainfall play vital role in suppression of PBW population and it can be used as effective tool in the sustainable management of PBW population in the cotton ecosystem.

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