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Seasonal population dynamics of gram pod borer (*Helicoverpa armigerpa* Hubner) on chickpea in Indore

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Abstract
To findout the effect of meteorological parameters on seasonal population dynamics of gram pod borer (*H. armigerpa* Hubner) (GPB) on chickpea experiments were conducted at Institute of Agricultural Sciences, BRAUSS, Ambedkar Nagar, Indore during winter season (2018-2020) with JG-14ariety. The activity of these insects were initiated in 50th standard meteorological week (SMW) with 0.24 and 0.36 larvae/plant peak population of GPB with 2.04 and 2.24 individuals / plant on 6th and 7th SMW respectively whereas population was gradually decrease and remained active up to 10th SMW with 0.28 and 0.32 respectively.
The correlation coefficient between GPB with population and the meteorological parameters *viz.*, relative humidity (r=0.06), maximum temperature (r=0.09) and minimum temperature (r=0.24) was exhibited non-significant positive impact on population fluctuation. The wind velocity (r=0.57*) was found significant positive impact on larval population of GPB during 2018-19. In the year 2019-20 GPB population showed significant negative correlation with minimum temperature (r= -0.65*) whereas relative humidity (r= -0.45), maximum temperature (r= -0.52) and wind velocity (r= -0.42) were exhibited non-significant negative impact on population fluctuation of GPB.

Keywords: Chickpea, seasonal population, meteorological parameters, gram pod borer

Introduction
Chickpea called the 'King of pulses' in India. Chickpea provides rich source of soluble fiber. It is useful in lowering the cholesterol. It contains zinc, folic acid and protein. Chickpea contains vitamins, minerals, complex carbohydrates and are the chief source of protein for the vegetarian diet, fat content is low and most of this is unsaturated (Patel 2023) [8].
India, with >28 Mha pulses cultivation area, is the largest pulse producing country in the world. It ranks first in area and production with 31 per cent and 28 per cent respectively. During 2020-21 our productivity at 885 kg/ha, has also increased significantly over last 05 year.
Among biotic and abiotic stress, the major factor for low yields of chickpea is the damage caused by gram pod borer *Helicoverpa armigera* (Hubner) from vegetative to pod stage (Dhingra *et al.* 2003) [2].
However, chickpea is infested by near about 57 insect species and other arthropods (Lal, 1992) [5], but all are not of equal significance. *H. armigera* is reported to feed and breed on 182 species of host plants belonging to 47 families in India (Pawar, 1998) [9]. *H. armigera* is a fascinating and one of the most prevailing insect pests in agriculture. The problem of this pest is exaggerated due to its direct infestation on fruiting structures, rapacious feeding habits, high mobility and high fecundity, multivoltine nature, overlapping generations, nocturnal behavior, wide genetic diversity, an ability to withstand, metabolize and avoid toxic chemicals (Sarode, 1999) [10]. The population density of insect pests fluctuates when there is a change in weather conditions. Seasonal population is regulated by the abiotic factors such as temperature, rainfall, relative humidity, sunshine hours, wind velocity, etc. At the same time adequate ecological data is prerequisite for integrated pest management, which can therefore be enhanced after shaping the seasonal abundance (Mathur *et al.* 2003) [7]. The knowledge on the seasonal population dynamics of gram pod borer will certainly be helpful and essential in developing integrated pest management systems with ecological and economical balance. With this aim the experiment was carried out to study the population dynamics of *H.* armigera on chickpea and to find out their correlation with the meteorological parameters.

Materials and Methods

An experiment was conducted with plot size 10x12 m^2 was sown with chickpea variety JG-14 along with spacing row to row 0.30 m and plant to plant is 0.10 m with row length is 10 m. The number of row per plant is 40 during 2018-19 and 2019-20 to record population of gram pod borer.

The weekly observations of larval population per plant were recorded randomly from their appearance till harvest of the crop. The twenty five plants were randomly selected and tagged. Based on these observations mean larval population was worked out. The data was statistically analyzed after suitable transformation and presented with meteorological parameters. The meteorological data was obtained from meteorological observatory, College of Agriculture, Sehore (MP)

Results and Discussion

Effect of weather parameter on Population of Gram pod borer:

The seasonal population dynamics of GPB on chickpea crop during 2018-19, was initiated in 50th Standard Meteorological Week (SMW) with 0.24 larvae/plant. During this SMW the maximum temperature, minimum temperature, winds velocity and relative humidity 25.7^{0}C, 6.7^{0}C, 1.40 km/h and 80.43% respectively. Thereafter the activity of GPB population was fluctuated gradually increase and decrease and reached at peak with 2.04 larvae/ plant on 7th SMW. When the favorable weather parameters were occurred, during these period maximum temperatures, minimum temperatures, wind velocity and relative humidity 29.60^{0}C, 14.0^{0}C, 2.9km/h and 82% respectively, after that it was gradually declined as increased age of crop and remained active up to 10thSMW with 0.28 larvae/plant. For this duration maximum temperature, minimum temperature, wind velocity and relative humidity were 31.6 °C, 18.1 °C, 1.73 km/h and 80.0% respectively.

The seasonal population dynamics of GPB on chickpea crop during 2019-20 was commencement in 50th SMW with 0.36 larvae/plant. In this SMW the maximum temperature, minimum temperature, winds velocity and relative humidity 27.5 °C, 10.0 °C, 3.14 km/h and 81.14% respectively. Subsequently the activity of GPB population was oscillated steadily increase and decrease and reached at peak with 2.24 larvae/ plant on 6th SMW. When the favorable weather parameters *i.e.* maximum temperatures, minimum temperatures, wind velocity and relative humidity were 25.7 °C, 5.7 °C, 2.7 km/h and 67.3%respectively, afterward it was steadily declined as increased age of crop and remained active up to 10thSMW with 0.32 larvae/plant. For this duration maximum temperature, minimum temperature, wind velocity and relative humidity were 31.8 °C, 9.9 °C, 4 km/h and 76.9% respectively. Similar findings have been reported by Dubey *et al*. (1995) [3] Jadhav and Suryawanshi (1998) [4], Yadav and Lal (1988) [13] and Vichiter *et al*. (2005) [14].

Correlation studies

The correlation coefficient of 2018-19 and 2019-20 are presented in table-2. In the year 2018-19 the correlation coefficient between GPB population and meteorological parameters *viz.*, relative humidity (r=0.06), maximum temperature (r=0.09) and minimum temperature (r=0.24) was exhibited non-significant positive impact on population fluctuation. The wind velocity (r=0.57*) was found significant positive impact on larval population of GPB (Table 2).

Table 1: Larval population of Gram pod borer (*H. armigera* Hubner).

SMW	Larval population/ plant	
	2018-19	2019-20
46	0	0
47	0	0
48	0	0
49	0	0
50	0.24	0.36
51	0.6	0.68
52	0.88	1.00
1	1.08	1.36
2	1.24	1.72
3	1.64	1.56
4	1.48	1.28
5	1.12	1.76
6	1.2	2.24
7	2.04	1.64
8	1.36	1.16
9	0.76	0.64
10	0.28	0.32

SMW: Standard Meteorological Week

Table 2: Correlation (r) and regression of abiotic factors on GPB larval population.

Attributes	Season		RH (%)	Temp. (Max.)	Temp. (Min.)	WV (km/hr.)
Gram pod borer (*H. armigera* H.) (Larva/ plant)	2018-19	r	0.06	0.09	0.24	0.57*
		R^2	0.003	0.008	0.057	0.328
	2019-20	r	-0.45	-0.52	-0.65*	-0.42
		R^2	0.202	0.274	0.424	0.176

Significant at 5% Level= *

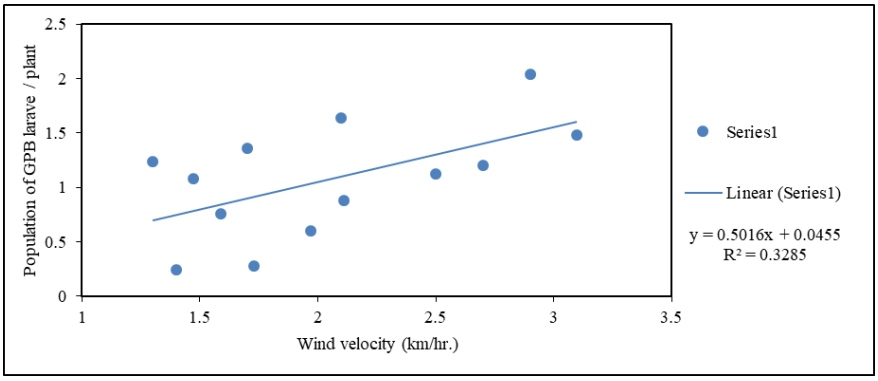

Fig 2: Regression of wind velocity (km/hr) with GPB larvae/plant (2018-19)

During 2019-20 the GPB population showed significant negative correlation with minimum temperature (r= -0.65*) whereas relative humidity (r= -0.45), maximum temperature (r= -0.52) and wind velocity (r= -0.42) were exhibited non-significant negative impact on population fluctuation of GPB (Table 2).

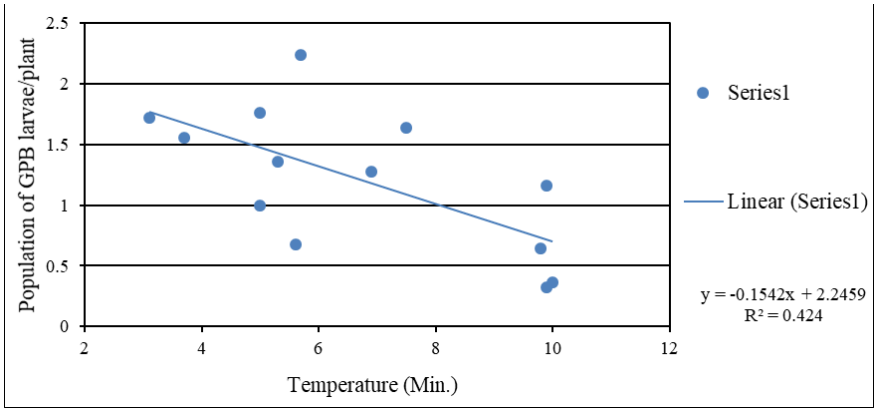

Fig-3: Regression of minimum temperature with GPB larvae/plant (2019-20).

The present findings are slightly supported by Patnaik and Sanapati (1996) found significant negative correlation existed between temperature (mean minimum and maximum) and larval incidence. Reddy *et al*., (2009) [11] observed the population has non-significantly positive correlation with both minimum and maximum temperature and rainfall and larval population showed positive significant correlation (0.03) with wind velocity and Lai et. al., (2012) [6]

Table3: Meteorological data recorded at Sehore (M.P.) during *Rabi* 2018-19 and 2019-20.

***Rabi* (2018-19)**					
SMW	**Rains (mm)**	**RH (%)**	**Temp. (°C)**		**WV (km/hr)**
			Max	**Min**	
46	0	80.71	30.2	17.7	1.73
47	0	80.71	29.3	12	2.46
48	0	78.86	29.8	11.7	1.9
49	0	81.71	27.7	8.5	1.74
50	0	80.43	25.7	6.7	1.4
51	0	79	21.1	4.5	1.97
52	0	81.14	22.7	5.3	2.11
1	0	82.14	29.4	11.7	1.47
2	0	80.43	25	9	1.3
3	0	78	24.6	10.3	2.1
4	0	82	28.7	16.1	3.1
5	0	76	29.1	11.1	2.5
6	0	77	27.1	12.1	2.7
7	0	82	29.6	14	2.9
8	0	77	31.7	14.7	1.7
9	0	78	33.3	15.1	1.59
10	0	80	31.6	18.1	1.73

***Rabi* (2019-20)**

SMW	**Rains (mm)**	**RH (%)**	**Temp. (°C)**		**WV (km/hr)**
			Max	**Min**	
46	0	78.86	30.5	12.3	2.11
47	0	81.71	28.8	12.5	1.47
48	0	80.43	29.3	14.3	1.3
49	0	79	27	10	2.17
50	0	81.14	27.5	10	3.14
51	0	82.14	25.5	5.6	1.97
52	0	80.43	25.1	5	2.11
1	0	77.86	24.8	5.3	1.47
2	0	82.14	25.9	3.1	1.3
3	0	75.57	22.3	3.7	2.1
4	0	76.63	26.7	6.9	3.1
5	0	71.9	23.6	5	2.5
6	0	67.3	25.7	5.7	2.7
7	0	77.5	28.9	7.5	2.9
8	0	79.6	31.1	9.9	1.7
9	0	71.5	31.5	9.8	3.1
10	0	76.9	31.8	9.9	4

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