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Influence of weather parameters on stem borer (*Chilo partellus*) infestation on maize

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Abstract

The field experiment was conducted to record effect of weather parameters on infestation of stem borer (*Chilo partellus*) on maize crop during *Kharif* 2010 of research farm Birsa Agricultural University. The maximum infestation recorded on the 33 SMW (3rd week of August 2010) with stem borer (6.9%) and dead heart (6.5%) respectively. The highest damage was received when maximum temperature was 30.8°C, minimum temperature (23.5°C), maximum relative humidity (87.1%), minimum relative humidity (76.9%), sunshine and rainfall was 41.0 hrs. and 22.7 mm respectively in the maize crop. The influence of maximum temperature revealed that it correlated highly significant and positive correlation with leaf infestation ($r=0.707^{**}$) and dead heart ($r=0.700^{**}$). Maximum relative humidity showed significant and negative correlation with leaf infestation ($r=-0.641^*$) and dead heart ($r=-0.606^*$).

Keywords: maize, stem borer, dead heart, *Kharif*, temperature and relative humidity

Introduction

Maize (*Zea mays* L.) is one of the most flexible rising crops with high adaptableness under different agro-climatic conditions. Worldwide, it is known as queen of cereals because it has the highest genetic yield potential among the cereals. It is cultivated globally for sweet corn, grain, fodder, green cobs, baby corn, pop corn and various uses in food industries. It has higher nutritional values with contain in phosphorus, magnesium, manganese, zinc, copper, iron and selenium, and has small amounts of potassium and calcium. In India, Maize is the third most important cereal crop after rice and wheat with a production of 21.3 million metric tons during 2010-11 (Anonymous, 2011) [3]. It has dual importance as food and fodder in addition to industrial uses. A dozen of insect pests cause economic losses to maize crop but among them *Chilo partellus* (stem borer) is most dominant contributing 90-95 per cent of the total damage in *Kharif* season (Jalali and Singh, 2002) [4]. It infests the plant at all stages and prevalent during *Kharif*. The insect *C. partellus* completes its life cycle within 5-6 weeks. It has about 14-28 days larval period and major loss is started from the early stage of the crop. The newly hatched larvae crawl over the leaf and then feed on the folded leaves of young maize plant and resulted in pinholes in the horizontal row when leaves open up. The more developed larvae attack downward and make large and oblong holes vertically. It feeds on meristem, as a result the central leaf of such plants dries up making dead heart. Such a plant usually dies or gives rise to tillers. Mahadevan and Chelliah (1985) [6] reported that the speed of development and damage of the stem borer was higher during summer than other seasons of the year.

Materials and Methods

The field experiment was conducted in the research farm Birsa Agricultural University, Kanke, Ranchi during *kharif* 2010. The maize variety HQPM-1 was grown in third week of July adopting normal agronomic practices except insecticidal application. The observations of damages done by stem borer (leaf infestation and dead heart) were taken on five randomly selected maize plants. The observational data was taken weekly interval soon after appearance of initial infestation and continued up to crop maturity. The recorded data of leaf infestation and dead heart were converted into percentage. The data were correlated with weather parameters *viz.* temperature (maximum and minimum), relative humidity (maximum and minimum), rainfall and sunshine which were collected from the department of Agricultural Physics and Climatology, B.A.U., Ranchi. Correlation coefficient (r) was calculated by the formulae as suggested by Agarwal (2009) [1].

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$$r = \frac{\sum xy - [(\sum x)(\sum y)] / n}{\sqrt{[\sum x^2 - (\sum x)^2 / n][\sum y^2 - (\sum y)^2 / n]}}$$

Where,

x, y = are characters under study

n = number of pairs of observation

Results and Discussion

The maximum temperature ranged between 28.2°C - 30.8°C, minimum temperature (18.2-23.5°C), maximum relative humidity (82.4-89.6%), minimum relative humidity (68.3-78.7%), sunshine hours (20.1- 59.2 hrs.) and rainfall (0-375.7mm) (Table 1). The initial damage of stem borer, leaf infestation (1.0%) and dead heart (0.5%) were recorded on 31st standard meteorological week (SMW) of 3rd August 2010 with weather parameters maximum temperature (29.6°C), minimum temperature (22.9°C), maximum RH (89.6%), minimum RH (78.7%), sunshine (46.4 hrs.) and rainfall (35.7mm) respectively. The highest infestation 6.9% (leaf infestation) and 6.5% (dead heart) were recorded when maximum temperature was 30.8°C, minimum temperature (23.5°C), maximum RH (87.1%), minimum RH (76.9%), sunshine (41 hrs.) and rainfall (22.7 mm) respectively on 17th August 2010 (33rd SMW) *i.e.* 31 days after sowing (DAS) of maize crop. Thereafter declining trend was obtained on 5th October of 40th SMW leaf infestation (2.7%) and dead heart (2.1%) respectively. The sudden decrease in the leaf infestation (1.5%) and dead heart (1.4%) was noticed on 38th standard meteorological week, it might be happened due to maximum

rainfall (375.7mm). After that from 38 DAS (34th SMW) to 52 DAS (36th SMW) infestations were comparatively similar and then started fluctuate in records with the unexpected rainfall (256.8 mm to 375.7mm) during the second and third week of September. These findings are supported more or less by Ahad *et al.* (2008) [2] who reported that the maximum infestation of *Chilo partellus* who found infestation rose in summer months and declined more till beginning of winter season. The experimental result were similar to the findings of Kandalkar *et al.* (1996) [8], they reported that the peak infestation of *C. partellus* was noticed between 31-68 days after sowing. The infestation of *Chilo partellus* was found highest at the temperature of 32.5 °C relative humidity at 68% (Zulfiqar *et al.*, 2010) [7] which is more or less similar to the findings.

The stem borer damages, per cent leaf infestation and dead heart on maize were correlated with different weather variables. The leaf infestation caused by stem borer was highly significant and positive correlation with maximum temperature ($r = 0.707^{**}$) and dead heart ($r = 0.700^{**}$) respectively (Table 2). The weather parameter minimum temperature was showed positive and non-significant correlation with leaf infestation ($r = 0.215$) and dead heart ($r = 0.225$). In the case of maximum relative humidity, it was showed negative and significant correlation with leaf infestation ($r = -0.641^*$) and dead heart ($r = -0.606^*$) while minimum relative humidity was negative and non-significant correlation with $r = -0.141$ and $r = -0.218$ respectively. The weather variables rainfall (mm) and sunshine (hrs.) were also recorded non-significant and negative correlation. These records also revealed by Jeengar (2005) [5] with reported temperature and relative humidity significant with the stem borer infestation.

Table 1: Effect of weather parameters on maize stem borer (leaf infestation and dead heart) SMW= Standard Meteorological Week DAS=Days after sowing

SMW	Das	Date of Observation	Percent Infestation By Stem Borer		Temperature (°C)		Relative Humidity (%)	Sunshine	Rainfall	
			Leaf Infestation	Dead Heart	Max. Temp.	Min. Temp.	Max. RH	Min. RH(Hours)	(mm)	
31	17	03/08/2010	1.0	0.5	29.6	22.9	89.6	78.7	46.4	35.7
32	24	10/08/2010	2.4	2.9	30.4	22.7	87.3	71.9	59.2	20.4
33	31	17/08/2010	6.9	6.5	30.8	23.5	87.1	76.9	41	22.7
34	38	24/08/2010	4.0	4.5	30.2	22.1	83.3	77.6	30.3	28.3
35	45	31/08/2010	5.0	5.5	30.4	22.4	83.1	74.7	32.2	46.4
36	52	07/09/2010	4.3	4.3	30.2	22.3	85.0	77.3	32.2	10.2
37	59	14/09/2010	3.7	3.6	29.8	21.5	86.4	71.8	28.5	256.8
38	66	21/09/2010	1.5	1.4	28.2	20.9	88.6	78.0	20.1	375.7
39	73	28/09/2010	2.9	3.1	29.7	18.2	85.0	68.3	45.1	0
40	80	05/10/2010	2.7	2.1	29.5	19.1	82.4	76.1	40.4	15.2

Table 2: Correlation of weather variables with per cent leaf infestation and dead heart done by *Chilo partellus*

Weather Variables	Correlation coefficient (r) of infestation of maize Stem borer with weather variables	
	Leaf infestation	Dead heart
Maximum Temperature(°C)	0.707**	0.700**
Minimum Temperature(°C)	0.215	0.225
Maximum Relative humidity (%)	-0.641*	-0.606*
Minimum Relative humidity (%)	-0.141	-0.218
Rainfall (mm)	-0.293	-0.278
Sunshine (hr.)	-0.221	-0.165

*Significant at 5%,

**Significant at 1%

Conclusion

The experimental findings showed that the optimum temperature was 30.8°C and 87.1 per cent relative humidity for growth, development and damages of *C. partellus*. The

assessment of correlation coefficient between the damage of stem borer and maximum temperature showed a highly significant and positive correlation *i.e.* leaf infestation ($r = 0.707^{**}$) and dead heart ($r = 0.700^{**}$). The maximum relative

humidity was recorded negative and significant correlation with leaf infestation ($r = -0.641^*$) and dead heart ($r = -0.606^*$). Therefore the stem borer was obtained more potential damages with respect to increasing the temperature and lost their account on increasing the relative humidity during *Kharif* season.

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