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Population dynamics of *Helicoverpa armigera* in pearl millet

■ A. B. MAKWANA[1], G. M. PARMAR[2]*, ASHA C. DETROJA[2] AND M.G. RATHWA[1]

[1]Department of Entomology, College of Agriculture, Junagadh Agriculture University, JUNAGADH (GUJARAT) INDIA
[2]Millet Research Station (J.A.U.), JAMNAGAR (GUJARAT) INDIA

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***Corresponding author:**

ABSTRACT :

Population dynamics of *Helicoverpa armigera* in pearl millet was studied during *Kharif* 2015 at Instructional Farm, Junagadh Agricultural University, Junagadh. The study revealed that the pest incidence commenced from seventh week after sowing in variety GHB-558 and was found active from August to September in the crop. The pest population increased in the last week of August and reaching to a peak level of 1.56 larvae per ear head. Then it was decreased (0.82 larvae/ear head) during the first week of September and remained active steady upto second week of September. Among the different parameters, maximum temperature and mean bright sunshine hours showed positive correlation whereas minimum temperature, morning relative humidity showed negative correlation with population of this pest but did not reached at significant level. However, the correlation between the pest population and evening relative humidity was significant and negative. Rainfall exhibited a non-significant and negative correlation with the pest population.

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INTRODUCTION

Pearl millet [*Pennisetum glaucum* (L.)R.Br.] commonly known as *Bajra/Bajri* in India. It is C4 plant with great adaptive characters to grow in arid and semi arid areas where no other food crop can be successfully grown. In fact, for the driest climate such as the saurastra and Kutch region it is compulsion rather than a choice crop for farmers. In these harsh areas farmers can get some grain for food and dry stover as feed for live stock. Although optimum rainfall required for pearl millet ranges from 250-300 mm, as it can give some yield even with rainfall as low as 150 mm. India is the largest producer of this crop, both in terms of area (7.8 Million ha) and production (9.25 million ton), with an average productivity of 1270 kg/ha. The major pearl millet growing states in India are Rajasthan, U.P., Haryana, Gujarat and Maharastra (Anonymous, 2016).

Pearl millet grain are used for human consumption and it was found to be 5.8 to 20.9 per cent protein, 63.1 to 78.5 per cent starch, 1.1 to 1.8 per cent crude fibres, 4.1 to 6.4 per cent fat and 1.4 to 2.6 per cent soluble sugar. Besides that, seed also constituent of minerals

like calcium, potassium, iron, zink, magnesium (Khairwal *et al*., 2007). Pearl millet contains calories than wheat, probably because of its higher oil content of 5 per cent, of which 50 per cent are polyunsaturated fatty acids. It is rich in calcium, magnesium, iron, zinc, manganese, riboflavin, thiamin, lysine and tryptophan. Pearl millet grain is gluten-free and thus is the only grain that retains its alkaline properties after being cooked which is ideal for people with gluten allergies. Apart from grain, the forage and stover at harvest is an important secondary product in low resource agriculture for animal feed and fuel. Pearl millet is a quick growing cereal and produces green fodder in shorter duration. Its fodder is free from dhurrin, the cyanogenic found in sorghum and hence can be fed at all stages of crop growth.

According to Balikai (2010) 26 insect and 2 non-insect pests were found feeding on pearl millet *viz.*, ear head worm, *Helicoverpa armigera*; Gujarat hairy caterpillar, *Amsacta moorei*; army worm, *Cirphis unipuncta*; stem borer, *Chilo zonellus*; blister beetle, *Cylindrothorax ruficolis*; shoot fly, *Atherigona varia socata*; surface grasshopper, *Chrotogonus brachypterous* and white grub, *Holotrichia consanguinea* (Patel *et al*., 1970). Among the various pests, the *H. armigera* is more common and destructive polyphagous pest. The damage caused by this pest depends on population of damaging stage of insect, crop growth stage, cropping pattern in the area and prevailing environmental conditions. Larval stage of this pest is observed at earhead stage and starts damaging on floral parts, milky grainsand mature grain which ultimately reduce the grain yield and quality also. Juneja and Raghvani (2000) recorded 10-15 per cent reduction in yield by this pest in pearl millet. Correlation of pest population with different weather parameters provide valuable information on the basis of such data a predictive model can be developed which can use for the forecast of pest population build-up and ultimately farmers can plan for plant protection strategies. The study of seasonal incidence will be useful to generate the information on population build-up of *H. armigera* in pearl millet crop. With a view to know the population dynamics of *Helicoverpa armigera* in pearl millet, an experiment was carried out at Junagadh Agricultural University, Junagadh during the *Kharif*-2015.

MATERIAL AND METHODS

The experiment on the population dynamics of *H. armigera* in pearl millet (GHB-558) was sown at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *Kharif* 2015. The crop was grown in plot size of 20 m x 20 m (400 m^2) keeping 45 cm x 10 cm spacing between row to row and plant to plant. In order to record the absolute population of *Helicoverpa*, all the recommended agronomical practice was followed to raise the crop. The plot was kept unsprayed throughout the seasons. The crop area was divided into 15 quadrates of size 1 m x 1 m. Ten earhead were selected randomly from each quadrates for observation. Absolute population of larvae was recorded at weekly interval in the morning hours. The observations were continue till harvesting of crops. The crop was sown on 29th June and harvested on 30th September. Mean larval population per plant was worked out and data were correlated with meteorological observations to ascertain the effect of abiotic factors on population fluctuation of *Helicoverpa*. Further, the impact of important environmental factor on population build up and correlation analysis were worked out by using standard statistical procedure as suggested by Steel and Torrie (1980). Weekly meteorological data on temperature, relative humidity, bright sunshine hours and rainfall in different standard weeks were collected from the meteorological observatory situated at the Instructional Farm, Junagadh Agricultural University, Junagadh during *Kharif* 2015. The present findings are also in agreement with them.

RESULTS AND DISCUSSION

The data (Table 1) indicated that the *Helicoverpa* infestation on pearl millet commenced with the seventh week after sowing *i.e.* in the month of August (33th standard week) with 0.24 larvae/earhead. The pest population increased in the last week of August (35th standard week) and reaching to a peak level of 1.56 larvae per earhead. However, it was decreased 0.82 larvae per earhead during tenth week after sowing *i.e.* first week of September (36th standard week). The larval population remained steady upto second week of September (0.82 to 0.54 larvae per earhead). The population decreased at low level upto the third week of September and thereafter, disappeared from pearl millet crop. The present finding is in close agreement with the report of Kapoor *et al.* (1982) and Trapsiya (2003) who stated that incidence of *H. armigera* commenced from

7th week after sowing and was found active from August to September in pearl millet. Peak activity of *H. armigera* in pearl millet during last week of August in was also reported by Juneja *et al.* (2015). Patel and Koshiya (1999) conducted the experiment to study the population dynamics of *H. armigera* on cotton, pigeonpea and chickpea. The study clearly revealed that the pest was first observed in the last week of July and remained active upto end of October in cotton crops. During these period populations shows violent fluctuations with three different peaks in the 1st week of September, the 1st week of October and the 3rd week of October, in cotton, pigeonpea and chickpea crop, respectively. In pigeonpea the pest was active from the 1st week of October to the last week of November but the maximum population was recorded during the last week of October. In chickpea, the pests was 1st observed in the 3rd week of November and reached a peak in the 3rd week of December, when the crop was at the podding stage. In this crop, the pest was effective from November to February. Among the various factors, maximum and minimum temperature as well as vapour pressure show decreasing trends, which contributed to population fluctuations.

The correlation study (Table 2) clearly showed that among the various physical factors of environment *viz.*, maximum temperature and mean bright sunshine hours showed positive correlation with the population build up of this pest but did not reach at significant level. Whereas minimum temperature and morning relative humidity showed negative correlation with population of this pest and did not show significant effect on population phenomena. However, the correlation between the pest population and evening relative humidity was significant and negative. Rainfall exhibited a non-significant and negative correlation with the pest population.

Poonia (2005) studied the impact of various abiotic factors on population buildup of *H. armigera* on green gram. It was found that pest showed positive correlation with maximum temperature, minimum temperature and morning relative humidity. A negative correlation was evidenced with evening relative humidity, wind speed and sunshine hours. Similar results were reported by Patel (1991); Reddy *et al*. (2001) and Ranjith and Prabhuraj (2013) on soybean and Juneja *et al.* (2015) on pearl millet. Trapsiya (2003) stated that the maximum and minimum temperatures showed negative correlation with population

Table 1 : Weekly population of *H. armigera* in pearl millet during *Kharif*-2015

Week after sowing	Standard Week	Larval population Per earhead	Temperature (°C)		Relative Humidity (%)		Mean bright sun shine (hrs/day)	Rainfall (mm)
			Maximum	Minimum	Morning	Evening		
1	27	0.00	34.8	26.5	82	61	1.4	0.0
2	28	0.00	34.9	26.8	85	74	0.8	0.0
3	29	0.00	33.4	26.6	87	74	0.4	6.6
4	30	0.00	29.4	24.9	95	92	0.2	272.8
5	31	0.00	30.9	25.4	90	80	1.5	4.0
6	32	0.00	32.1	25.1	88	71	0.8	0.0
7	33	0.24	33.0	24.9	90	64	2.2	11.6
8	34	0.60	32.1	25.4	87	66	2.1	3.8
9	35	1.56	32.9	24.8	83	57	1.2	0.0
10	36	0.82	34.1	24.0	78	46	6.8	0.0
11	37	0.54	33.9	24.7	82	57	6.0	94.5
12	38	0.40	31.5	24.7	92	81	3.6	119.8
13	39	0.00	33.2	22.7	81	66	9.8	0.0

Table 2 : Correlation co-efficient between larval population of *H. armigera* and weather parameters in *Kharif*-2015

Season	Temperature (°C)		Relative humidity (%)		Bright sunshine (hrs/day)	Rainfall (mm)
	Maximum	Minimum	Morning	Evening		
Kharif	0.120	-0.284	-0.372	-0.579*	0.129	-0.133

*Significant at P = 0.05 (r = 0.553) P = 0.01 (r = 0.684)

of the pest and did not reached at significant level and found to be non-significant in relation to population of this pest. Significantly negative correlation between *Helicoverpa* population and evening relative humidity was found by Balasubramaniain *et al*. (1981) on cotton, Umbarkar (2009) on green gram, Kanhare (2010) on cowpea and Patel *et al*. (2013) on sorghum. Ranjith and Prabhuraj (2013) studied on incidence of *H. armigera* on sorghum and reported that rainfall and morning relative humidity recorded negative but non-significant correlation with larval incidence in sorghum. This is also in accordence with the findings of Juneja *et al*. (2015) on pearl millet.

Conclusion:

It is evident from the result the pest incidence commenced with the seventh week after sowing *i.e.* in the month of August with 0.24 larvae/earhead. The pest population increased with the advancement the crop age. The pest population increased in the last week of August and reaching to a peak level of 1.56 larvae per earhead and remained steady upto second week of September. Thereafter, the population decreased at low level upto the third week of September and thereafter, disappeared from pearl millet.The correlation study clearly indicated that among the various factors of environment *viz.*, maximum temperature and mean bright sunshine hours showed positive association whereas minimum temperature, morning relative humidity showed negative association with population of this pest but did not reached at significant level. However, the correlation between the pest population and evening relative humidity was significant and negative. Rainfall exhibited a non significant and negative correlation with the pest population.

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