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POPULATION DYNAMICS OF MAIZE STEM BORER, *CHILO PARTELLUS* (SWINHOE)AND ITS NATURAL ENEMIES

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ABSTRACT

The incidence of the pest begins from 3rd week of July and continued up to 3rd week of September with a peak activity in August. Parasitoid, *Cotesia flavipes* showed significant positive correlation with larval population during both the years. The abiotic factors, rainfall had significantly negative association with *C. partellus* in maize crop. The damaged plants caused by *C. partellus* were significantly negative correlated with minimum and maximum temperature in 2007 and 2008.

Key words:

INTRODUCTION

Maize (*Zea mays* Linnaeus) known as 'corn' is one of the most important cereals crops ranking third among the food crops next to rice and wheat, both in respect of area and production in the world. It occupies 17 per cent of the world acreage and accounts for about 24 per cent of the world production of grain (Anon., 2009). In India maize is cultivated in area of 6.21 million hectares with the production of 13.95 million tones of grains with 2246.3 kg ha^{-1} productivity (Anon., 2009a). Gujarat occupies 0.44 million hectares of area producing 0.88 million tones of grain with 1990 kg ha^{-1} productivity (Anon., 2009b). It is attacked by nearly 130 species of insect pests in India (Atwal and Dhaliwal, 2002). Among these, maize stem borer (*C. partellus*) is notorious pest of this crop and plays havoc all over the world (Atwal, 1976). The loss in yield due to infestation of *C. partellus* was 60 per cent and stem infestation level reached 98 per cent (Neupane *et al.,* 1985).Its damage reached up to75 per cent and sometimes the crop is totally failed if remains uncontrolled (Latif *et al.,* 1960).

In spite of regular occurrence of *C. partellus* on maize crop and causing economics losses, systemic work has been done on population dynamic of maize stem borer, *C. partellus* in North Gujarat area.

MATERIAL AND METHODS

GM–2 variety of maize was grown in an area of 500 m^2 at Agricultural School Farm, S. D. Agricultural University, Khedbrahma during two consecutive *kharif* season 2007 and 2008 to study the population fluctuation of *C. partellus*. The crop area was divided into four equal quadrates. From each quadrate 25 plants were selected randomly for recording the observations. The plants damaged by stem borer were recorded from each quadrate at weekly interval starting from one week of germination till harvest of the crop. To record the larval population in selected plants, numbers of larvae were noted by splitting the stem. These larvae were brought to the laboratory and reared till pupation for recording the emergence of parasitoids, if any. The parasitoids emerged out from the collected larvae were recorded. The pest population data were correlated with biotic and abiotic factors.

RESULTS AND DISCUSSION

To know the population dynamics of maize stem borer and its natural enemies and the effect of different biotic and abiotic factors on the population of *C. partellus* on maize, a study was carried out for two consecutive *kharif* season 2007 and 2008. Maize crop was mainly infested by maize stem borer during both the year of study. Larval parasite *C. flavipes* was also found parasiting larvae of this pest (Plate I). Mild incidence of maize aphid (*Rhopalosiphum maidis* F.) was observed during *kharif* 2007 but it was scattered on some few plants. The data obtained for the first and second year are presented in Table 1 and 2, respectively.

First year: The result presented in Table 1 and Fig. 1 indicated that the larvae of this pest first commenced (0.12 larvae/plant) on 29th standard week (3rd week of July) which had 7.31 per cent damage to the maize plants. The number of larvae per plant increased gradually and reached to a peak level (1.12 larvae/plant) on 34th standard week (3rd week of August). During the season 49.01 per cent damage was recorded. Larval parasitism due to *C. flavipes* was

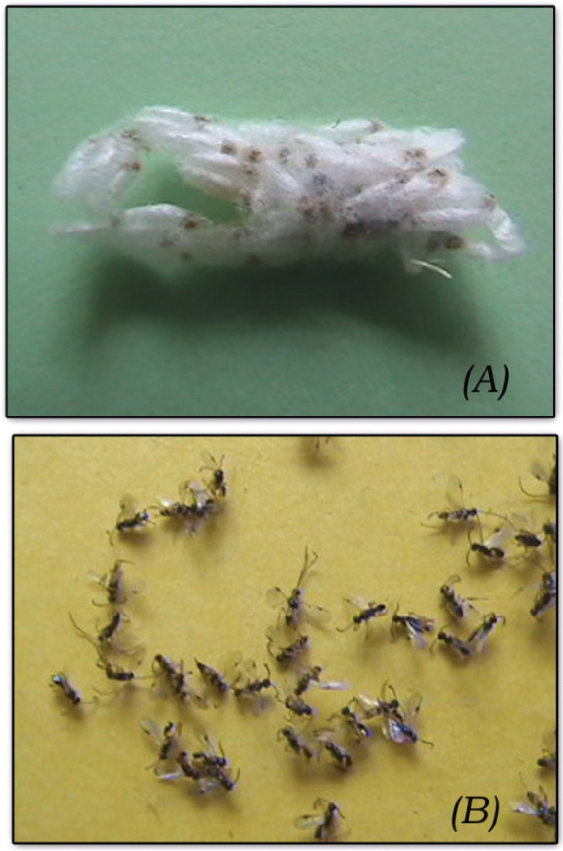

Plate 1. *Cotessia flavipes cameroon* – a endolarval parasite of *C. partellus* (A) Cacoon (B) Adult

27.71 per cent. After 34th standard week, the larval population was suddenly decreased and found to be 0.72 larvae per plant on 35th standard week (4th week of August). The decreasing trend of the pest was continued from 34th standard week and it was disappeared on maize from 39th standard week (3rd week of September). Maximum damage was recorded in the month of September during study period *i.e.,* 50.17 per cent.

Second year: The observations on *C. partellus* recorded during the year 2008 (Table 2 and Fig. 2) showed that like first year, the incidence of stem borer first appeared (0.25 larvae/plant) on maize from the 27th standard week (1st week of July) with 13.64 per cent plant damage. The number of larvae per plant increased slowly and reached to a peak (1.2 larvae/plant) on 32nd standard week (1st week of August) when the pest caused 45.99 per cent damage to maize crop. The larval parasitism was 22.22 per cent. The abiotic factors like minimum and maximum temperature, relative humidity and rainfall were 25.0°C, 30.4°C, 85.0 per cent and 50.0 mm, respectively. After 32nd standard week, the larval population was decreased suddenly and found to be 0.2 larvae per plant on 35th standard week (4th week of August). The decreasing trend of the pest was continued from 32nd standard week and it was disappeared on maize crop from 35th standard week (1st week of September).

Looking to the pest activity recorded during both the years, it is observed that the larval population of *C.*

Table 1. Population dynamics of *C. partellus* in relation to biotic and abiotic factors during 2007

Standard week	Month and Week		Larvae/ plant	Damage (%)	Larval parasitism (%) *Cotesia flavipes*	Abiotic factor			
						Temperature (ºC)		Relative Humidity (%)	Rainfall (mm)
						Min	Max		
26	June	IV	0.00	0.00	0.00	26.0	30.8	90.8	61.8
27	July	I	0.00	0.00	0.00	24.1	26.7	94.3	181.8
28		II	0.00	0.00	0.00	25.4	30.1	92.0	178.8
29		III	0.12	7.31	4.00	25.4	32.5	90.5	10.4
30		IV	0.32	18.82	8.00	26.4	32.9	87.1	90.2
31		V	0.48	33.47	16.66	25.8	33.2	89.8	21.2
32	August	I	0.72	39.85	21.42	24.6	29.2	92.9	163.2
33		II	0.88	48.13	23.07	26.0	30.8	89.4	19.4
34		III	1.12	49.01	27.71	25.1	31.1	88.1	39.8
35		IV	0.72	49.48	16.66	25.9	32.0	90.6	31.0
36	September	I	0.58	50.17	7.14	25.6	32.4	90.0	75.8
37		II	0.12	49.95	0.00	24.3	33.9	92.4	0.0
38		III	0.08	49.1	0.00	24.6	35.1	90.8	5.0
39		IV	0.00	49.1	0.00	24.4	33.7	91.4	31.2
40	October	I	0.00	49.1	0.00	19.7	34.5	87.1	0.0

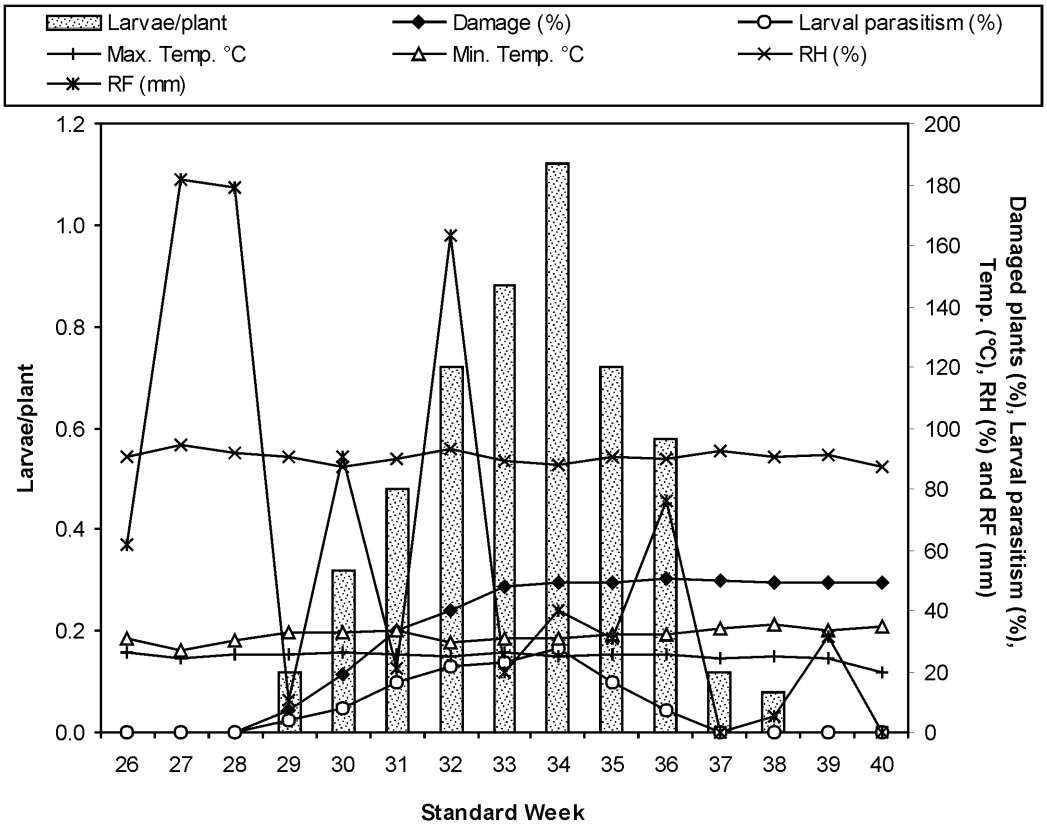

Figure 1. Population dynamics of *C. partellus* in relation to biotic and abiotic factors during (2007)

Table 2. Population dynamics of *C. partellus* in relation to biotic and abiotic factors during 2008

Standard week	Month and Week		Larvae/ plant	Damage (%)	Larval parasitism (%) *Cotesia flavipes*	Abiotic factor			
						Temperature (ºC)		Relative Humidity (%)	Rainfall (mm)
						Min	Max		
26	June	IV	0.00	0.00	0.00	26.0	36.5	85.1	0.0
27	July	I	0.25	13.64	0.00	26.7	33.4	89.4	0.0
28		II	0.40	18.04	10.00	25.0	30.4	86.1	100.0
29		III	0.48	25.49	18.18	25.0	33.5	69.2	0.0
30		IV	0.72	32.38	25.00	23.8	31.5	89.7	72.4
31		V	0.92	42.89	27.27	23.8	32.5	89.2	50.6
32	August	I	1.20	45.99	22.22	25.0	30.4	85.0	50.0
33		II	0.96	50.02	20.83	23.1	28.2	87.4	58.0
34		III	0.72	49.90	11.11	24.1	31.2	92.0	198.0
35		IV	0.2	48.66	0.00	24.8	32.7	91.0	27.0
36	September	I	0.00	48.31	0.00	26.2	35.4	85.0	0.0
37		II	0.00	48.31	0.00	25.8	34.8	92.0	40.8
38		III	0.00	48.31	0.00	23.4	32.7	89.8	42.2
39		IV	0.00	48.31	0.00	24.0	32.4	79.2	0.0
40	October	I	0.00	48.31	0.00	22.2	31.8	80.2	0.0

Table 3.Correlation coefficient between *C. partellus* and biotic as well as abiotic factors

Year	Stem borer	Larval parasitism	Abiotic factor			
			Temperature (ºC)		Relative Humidity	Rainfall
			Minimum	Maximum	(%)	(mm)
2007	Larval population	0.963*	0.358	–0.177	–0.298	–0.216
	Damaged plant (%)		–0.251	0.548*	–0.314	–0.511*
2008	Larval population	0.913*	–0.227	–0.677*	0.106	0.213
	Damaged plant (%)		–0.527*	–0.364	0.182	–0.128

*Significant at 5 % level

partellus commenced during early July when the crop was 15 days old and reached to a peak level in August and it was disappeared from mid September when the crop was 70 days old. It indicates that the stem borer remained active on maize crop from July to September with a single peak in August during both the years. Singh and Sharma (1984) and Patel (2005) reported that the peak emergence of adults of *C. partellus* occurred in August but declined gradually in September–October. These reports tallied with the present findings.

Correlation coefficient between *C. partellus* and biotic as well as abiotic factors: The correlation coefficient results (Table 3) revealed that the parasitoid *C. flavipes* showed significant positive correlation with larval population of *C. partellus* with critical value of 0.963 and 0.913 during first and second year, respectively. Parasitoid *C. flavipes* showed significant positive correlation with larval population during both the years. Significant positive correlation of biotic agents was observed by Jalali *et al*. (2000) and Patel (2005) which is in conformity with the present findings. The abiotic factors, rainfall (r = 0.511) had significantly negative association with larval population on maize during 2007.

The damage due to *C. partellus* was significantly negative correlated with minimum and maximum temperature in 2007 and 2008. The relation between damaged plants, relative humidity and rainfall were not established during the year 2007 and 2008.

The negative correlation of wind velocity and minimum temperature with *C. partellus* incidence in sorghum was reported by Nandihalli *et al*. (1991) and Kandalkar *et al*. (2002), respectively. Whereas, Patel (2005) reported that the abiotic factors, sunshine hours and rainfall had significant negative and positive correlation with larval population during the year 2004, respectively.

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