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INVESTIGATION ON THE INCIDENCE OF MAIZE STEM BORER, *CHILO PARTELLUS* (SWINHOE) IN MAJOR MAIZE GROWING DISTRICTS OF RAJASTHAN

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ABSTRACT

Survey studies were carried out in farmers' fields in four maize growing districts of Rajasthan viz., Bhilwara, Chittorgarh, Udaipur and Banswara in 28 talukas, covering 168 villages, 840 fields/farmers and 25,200 plants during 2006 and 2007 to determine the dominant lepidopteran insect pests causing economic losses in maize ecosystem. Stem borer, *Chilo partellus* (Swinhoe) infestation varied in four districts. Maximum stem borer infestation, 13.17 and 17.19 per cent, was recorded in Bhilwara district during 2006 and 2007, respectively followed by 12.35 and 15.43, 11.28 and 13.83 and 10.16 and 11.25 per cent in Chittorgarh, Banswara and Udaipur districts, respectively with average infestation of 11.74 and 14.43 per cent during 2006 and 2007, respectively. The mean of dead heart, stem borer holes , tunnel length and tassel breakage in surveyed area was 1.59 and 3.55 per cent;16.79 and 23.08 holes per plant;5.93 and 7.08 cm, and0.41 and 1.81 per cent respectively during 2006 and2007. The maize crop is also infested by the pod borer *H. armigera* and caused cob damage ranging from 0.96 to2.03 and0.39 to2.46 per cent during 2006 and 2007 respectively.

Key words: Maize, *Chilo partellus, H. armigera*, dead hearts, stem tunnel, tassel breakage

INTRODUCTION

Maize is an important cereal crop covering 6.67 million hectare area of India. Rajasthan accounts 1.11 million hectare area under maize crop with 2.07 million tones total production and 1.863 tones/ha productivity. Rajasthan contributes 16.66 per cent and 12.94 per cent in the area and production of maize in the country. Often the yield realized by the farmers is much less than the built in yield potential of the variety. Inspite of taking due care of the production components, at time the insects take a heavy toll of the crop thus bringing crop yield very low. The insect pests complex changes in time and space. The insect pests have increased due to the large scale cultivation of maize as sole crop and wide spread use of insecticides for the pest control. Potential losses due to insect pests in maize on global basis is estimated to be of 14-18 per cent (Oerka, 2002), which is 52 million tons valued at $ 5.7 billion annually (James, 2003), while yield loss estimates for maize stem borer vary greatly depending upon the country, season, maize variety and fertilization (Kfir *et al.* 2002, De Groote *et al.* 2003). However, in studies with *C. partellus* alone, yields in East Africa were reduced by 15-45 per cent (Seshu Reddy and Sum, 1992). In South Africa, yield losses in maize and sorghum exceeded 50 per cent (Kfir *et al.* 2002). The yield losses in maize by *C. partellus* ranging from 5.14 to 91.22 per cent reported by earlier workers in India (Chatterji *et al.*, 1969, Singh and Sajjan, 1982). At the lower limit of 25 per cent damage, the average loss in maize in the *kharif* season at a conservative estimate, comes to Rs. 1105 million annually (Siddiqui and Marwaha, 1994).

The important area under maize in Rajasthan is in Bhilwara, Chittorgarh, Udaipur and Banswara contributing 1.81, 1.75, 1.80 and 1.41 lacks hectare with total production of 3.01, 3.74, 3.60 and 2.83 lacks tone, respectively. This comprised 60.9 per cent area and 63.65 per cent production of maize in Rajasthan. Looking to this a survey was made to know the dominant insect pests causing economic losses in four important maize growing districts namely Bhilwara, Chittorgarh, Udaipur and Banswara . The insect pests covered in survey are maize stem borer, cut worm and gram pod borer.

MATERIALS AND METHODS

The survey of maize growing fields was conducted during Kharif, 2006 and 2007 to know the infestation of lepidopteran insects specially stem borer, cut worm and gram pod borer. For this, each district was divided in group/ taluka for uniform collection of data. Further six villages were selected from each taluka and five fields from each villages and thirty plants from each field were chosen from each field for survey programme. The selection of villages and fields were random to cover whole taluka and villages.

Therefore, the survey was done in seven talukas from each district, hence total 28 taluka, covering 168 villages, 840 fields/farmers and 25,200 plants were chosen each year for survey. The selection of plants was done on 'W' based random sample. The 16 plants were selected from both outer arms and 14 plants from inner arms to make a sample of 30 plants. Every selected plant was tagged by red coloured tape for further collection of observations.

Observations on stem borer infestation (%), pinholes injury, leaf windowing, dead hearts, number of holes on leaf/ stem due to stem borer, length of tunnels(cm) caused by stem borer and tassel breakage were recorded. Statistical analysis was done using randomized block design.

RESULTS AND DISCUSSION

The data obtained during the survey period (Table 1) showed that among all the four districts surveyed, maximum stem borer infestation, 13.17 and 17.19 per cent, was recorded in Bhilwara district during 2006 and 2007, respectively followed by 12.35 and 15.43, 11.28 and 13.83 and 10.16 and 11.25 per cent in Chittorgarh, Banswara and Udaipur districts, respectively with average infestation of 11.74 and 14.43 per cent during 2006 and 2007, respectively. The infestation of Bhilwara was statistically at par with Chittorgarh district.

Dead heart formation: The mean of dead heart formed in surveyed area was 1.59 and 3.55 per cent during two consecutive years, respectively while the maximum dead hearts 2.00 and 4.35 per cent in 2006 and 2007, respectively were recorded from Bhilwara followed by 1.49 and 2.56; 1.48 and3.75 and 1.4 and 3.55 per cent dead hearts in 2006 and 2007 respectively in Udaipur, Banswara and Chittorgarh.

Stem borer holes on leaves/stalk: The data on holes caused by stem borer on leaves and stem showed that infestation was directly related with number of holes formed on leaves and stem. Stem borer holes were also more where infestation was high. Chittorgarh district had more stem borer holes (2.91 and 25.04 per plant) which are at par with Bhilwara 18.75 and 25.11 holes per plant during 2006 and 2007, respectively, followed by 14.39 and 12.74 holes per plant in 2006 and 21.35 and 20.83 holes per plant in 2007 in Banswara and Udaipur districts. The average numbers of holes found on the infested plants in surveyed area were 16.79 and 23.08 holes per plant during 2006 and 2007, respectively.

Stem borer tunnel length (cm): The observation recorded on stem borer tunnel length (cm) showed that the longest tunnel length, 6.44 cm and 8.48 cm was in Chittorgarh district followed by 6.36 and 8.19 cm in Bhilwara during 2006 and2007 respectively but was at par with Bhilwara. Shortest tunnel length 4.92 & 4 .90 cm was recorded in Udaipur districts during surveyed period. The average tunnel length formed by stem borer in surveyed district was 5.93 and 7.08 cm, in 2006 and 2007, respectively.

Tassel breakage: It is observed that stem borer also damages tassel of maize crop. The data on tassel breakage in 2006 was found maximum 0.95 per cent in Banswara district followed by 0.43 per cent in Udaipur, whereas in 2007 maximum tassel breakage, 3.11 per cent, occurred in Chittorgarh, which is statistically at par with Bhilwara 1.92 per cent. The mean tassel breakage of surveyed area was 0.41 and 1.81 per cent only.

Cob damage caused by *Helicoverpa armigera:* It is observed from the surveyed area that the maize crop is also infested by the pod borer *H. armigera*. This pest damaged cobs of maize and spoiled cobs greatly. The damaged cobs ranged from 0.96 to 2.03 and 0.39 to 2.46 per cent during 2006 and 2007 respectively. The maximum damage 2.03 and 2.46 per cent was recorded in Chittorgarh and Bhilwara and minimum damage 0.96 and 0.39 per cent was recorded in Banswara and Udaipur districts respectively during 2006 and 2007.

The survey carried out in farmers field in four districts of Rajasthan during Kharif, 2006 and 2007 for assessment of intensity of borer infestation revealed that the maize stem borer, *Chilo partellus* (Swinhoe) was the dominant insect pest in maize crop ecosystem while gram pod borer, *Helicoverpa armigera* (Hübner) infestation was also noticed in the maize crop. The intensity of the maize borer infestation in surveyed fields did not varied considerably and was at par in all districts with average infestation of 11.74 and 14.43 per cent during both the years. The pest infestation was recorded from early stage and it persisted till the harvest. The results of the present survey studies are in close alignment with the other survey studies results conducted by Haile and Hofsvang (2010) and Assefa G. Amila K (1985). They reported the maize stem borer as a major pest of maize attacking crop from early stage till harvest and its intensity varied in various regions. The survey studies also revealed that the pests were able to survive from one season to another and during the dry periods remained as diapausing larvae on crop residues. These results confirm the results of present study where the fields with higher infestation in 2006 received the higher intensity of borer infestation during the second year (Duale and Nwanze 2010).

The fields in four districts of survey with the stem borer infestation resulted in dead heart formation, stem borer holes on stalk, tunnel length and tassel breakage in maize crop during the year 2006 and 2007. The mean dead heart formation, holes on stalk, tunnel length and tassel breakage in surveyed area was 1.59; 16.79 holes per plant,

Table 1. Survey of stem borer infestation in southern Rajasthan during Kharif 2006 and 2007

S. No.	Name of Districts	Infestation (%)		Dead heart (%)		No. of holes on leaves/plant		Tunnel length (cm)		Tassel breakage (%)		Pod borer damage (%)	
		2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
1.	Udaipur	18.59* (10.16)	19.59 (11.25)	7.02* (1.49)	9.22 (2.56)	3.64** (12.74)	4.62 (20.83)	2.33** (4.92)	2.32 (4.90)	3.75* (0.43)	5.55 (0.94)	1.87	0.39
2.	Bhilwara	21.28 (13.17)	24.49 (17.19)	8.14 (2.00)	12.03 (4.35)	4.39 (18.75)	5.06 (25.11)	2.62 (6.36)	2.95 (8.19)	2.22 (0.15)	7.96 (1.92)	0.96	2.46
3.	Chittorgarh	20.57 (12.35)	23.13 (15.43)	6.80 (1.40)	10.87 (3.55)	4.67 (21.29)	5.05 (25.04)	2.63 (6.44)	3.00 (8.48)	1.98 (0.12)	10.16 (3.11)	2.03	1.15
4.	Banswara	19.62 (11.28)	21.83 (13.83)	6.98 (1.48)	11.16 (3.75)	3.86 (14.39)	4.67 (21.35)	2.55 (6.01)	2.69 (6.75)	5.61 (0.95)	6.45 (1.26)	1.23	0.92
	Average	11.74	14.43	1.59	3.55	16.79	23.08	5.93	7.08	0.41	1.81	1.52	1.23
	CD at 5%	1.93	2.18	0.98	1.72	0.66	0.36	0.35	0.28	1.91	2.36	0.96	0.89

* represents arc sign value of given data; ** represents “0+0.5 value; Data presented in parenthesis are retransformed

5.93 cm and 0.41 per cent during 2006 and 3.55 per cent, 23.08 holes per plant, 7.08 cm and 1.81 per cent during 2007, respectively. Various workers have reported the maize borer, *Chilo partellus* as a major pest causing grain yield loss, dead heart, tunnel length. Songa et *al* (2001) reported that *C. partellus* damage reduced maize grain yield upto 40 per cent with tunnel length greater than 20 cm. and 33 per cent yield loss was found in plants with more than one stem borer exit hole. Similarly Daves *et a*l (2007) and Farid *et al* (2007) also reported that the borer damage occurred in crop from early vegetation stage to the tasseling stage. The leaf damage and stalk tunneling were significantly higher in susceptible crop varieties and the number of tunnels and the length of tunneling were significantly lower on the resistant plants.

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