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## Incidence of pink stem borer and natural enemies in different sowing dates of maize

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### Abstract

Among the different dates of sowing the stem borer damage in terms of number of pin holes was lowest (0.33 pin holes/ plant) at 14 DAS. Peak period of pink stem borer infestation (22.38) was observed at 70 DAS. The crop sown 4<sup>th</sup> week of July (28/07/2016) has recorded the maximum Leaf Injury Rating (LIR) (3.11). The lowest number of LIR was recorded on 2<sup>nd</sup> week of August (1.94). LIR causes due to stem borer observed lowest at 21 DAS and highest at 63 DAS in all dates of sowing. The crop sown 4<sup>th</sup> week of July (28/07/2016) has recorded the maximum percent dead hearts (18.67 %) followed by 3<sup>rd</sup> week of July (11.11 %). The lowest percent of dead hearts was recorded on 2<sup>nd</sup> week of August (5.60 %). Stem borer damage was observed lowest at 28 DAS and highest at 63 DAS in all dates of sowing.

**Keywords:** Date of sowing, maize, pink stem borer, leaf injury rating

### Introduction

Maize or corn (*Zea mays* L.) belongs to the family Poaceae. In India, maize is the third most important food crops after rice and wheat accounting for about 20% of the global area under cereals (FAO, 2005) [4]. The six major types of maize are dent, flint, pod, popcorn, flour, and sweet corn (Smith, 2013) [14]. Total twenty four insect pests and some natural enemies including seven coccinellid beetles and two predatory bugs and thirteen spider species were recorded in maize. (Patra, 2013) [10]. Amongst the most serious pests shoot fly and maize stem bore, (*Chilo partellus* Swinhoe, *Sesamia inferens* Walker) occurs as serious pests in India (Manjunath, 2013) [8]. Pink stem borer, *Sesamia inferens* is major insect pest of maize in C.G.(Deole *et al.*, 2013) [3]. The larvae of pink stem borer is present inside the stem of maize so that it cannot be easily controlled by foliar application of insecticides. A primarily loss due to *Sesamia inferens* in kharif season varies from 60 to 81.7% and in Rabi (winter) it varies from 25.7 to 78.9% (Sekhar *et al.* 2009) [12].

### Material and Methods

A field experiment was conducted during July, 2016 to November, 2016 at the Research cum Instructional Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.).

The treatment details are given below:

Season	: Kharif 2016-17
Name of variety	: Sugar-75
Design	: Randomized Block Design
Plant spacing	: 75cm×20cm
Plot size	: 10m×9m
1 <sup>st</sup> date of sowing	: 21/07/2016
2 <sup>nd</sup> date of sowing	: 28/07/2016
3 <sup>rd</sup> date of sowing	: 04/08/2016
4 <sup>th</sup> date of sowing	: 11/08/2016
5 <sup>th</sup> date of sowing	: 18/08/2016

Insect pests and natural enemies population was recorded at weekly interval on randomly selected plants. In case of larvae was counted per plant. Observation was started from sowing to harvesting of the crop. Insect pest succession was recorded as:

- Appearance of insect
- Stage of crop
- Peak period of activity
- Disappearance of insect

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**Result and Discussion****Number of pin holes caused by pink stem borer, *Sesamia inferens*.**

The results indicated that there was significant difference in the stem borer damage on crop sown at different dates. (Table 1) Among the different dates of sowing, the crop sown on 4<sup>th</sup> week of July (28/07/2016) has recorded the maximum number of pin holes (10.67 no. of pin holes/ plant) followed by 3<sup>rd</sup> week of July (9.90 no. of pin holes/ plant). The lowest numbers of pin holes were recorded on 2<sup>nd</sup> week of August (5.77 no. of pin holes/ plant). The stem borer damage in terms of pin holes was lowest (0.33 no. of pin holes/ plants) at 14<sup>th</sup> DAS in all dates of sowing. It has increased gradually to 0.69,

1.72, 4.74, 7.21, 8.87, 11.89, 16.98 and 22.38 with advance in age up to 21 DAS, 28 DAS, 35 DAS, 42 DAS, 49 DAS, 56 DAS, 63 DAS and 70 DAS respectively. However, the stem borer pin holes has decreased further to 16.40, 8.84, 5.52 and 2.46 number at 77 DAS, 84 DAS, 91 DAS and 98 DAS, respectively. The interaction effect between the date of sowing and age of the crop on the stem borer pin holes was observed to be significant (Table 1). Pin holes causes due to stem borer observed initially at 21 DAS in all dates of sowing. Lowest number of pin holes was (0.03 / plant) at 21 DAS on crop sown at 3<sup>rd</sup> and 4<sup>th</sup> week of August both and highest number of pin holes was recorded (30.32 / plant) at 70 DAS on crop sown at 4<sup>th</sup> week of July.

**Table 1:** Number of pin holes caused by pink stem borer, *Sesamia inferens*

Age of the crop	Dates of sowing					Mean
	1 <sup>st</sup> DOS (21/07/16)	2 <sup>nd</sup> DOS (28/07/16)	3 <sup>rd</sup> DOS (4/08/16)	4 <sup>th</sup> DOS (11/08/16)	5 <sup>th</sup> DOS (18/08/16)	
14DAS	0.48 (1.20)	0.64 (1.28)	0.56 (1.25)	0.00 (1.00)	0.01 (1.00)	0.33 (1.15)
21DAS	1.74 (1.65)	0.86 (1.36)	0.82 (1.35)	0.03 (1.01)	0.03 (1.01)	0.69 (1.28)
28DAS	4.58 (2.35)	1.34 (1.52)	1.41 (1.55)	0.58 (1.24)	0.70 (1.30)	1.72 (1.60)
35DAS	7.53 (2.92)	5.39 (2.52)	3.97 (2.22)	2.81 (1.95)	4.00 (2.23)	4.74 (2.37)
42DAS	6.84 (2.80)	8.63 (3.10)	6.01 (2.64)	5.96 (2.64)	8.61 (3.10)	7.21 (2.85)
49DAS	11.89 (3.58)	8.74 (3.12)	7.14 (2.85)	7.02 (2.83)	9.58 (3.25)	8.87 (3.13)
56DAS	9.65 (3.26)	18.96 (4.46)	9.64 (3.26)	8.68 (3.11)	12.53 (3.67)	11.89 (3.55)
63DAS	28.93 (5.47)	30.32 (5.59)	11.16 (3.48)	11.01 (3.46)	15.53 (4.06)	16.98 (4.17)
70DAS	19.09 (4.48)	18.27 (4.39)	22.33 (4.83)	18.41 (4.40)	21.78 (4.77)	22.38 (4.81)
77DAS	16.73 (4.21)	21.19 (4.71)	18.28 (4.39)	12.27 (3.63)	13.54 (3.81)	16.40 (4.15)
84DAS	12.60 (3.68)	12.61 (3.69)	6.98 (2.82)	4.39 (2.31)	7.65 (2.94)	8.84 (3.09)
91DAS	5.58 (2.56)	7.79 (2.96)	3.96 (2.22)	3.80 (2.21)	6.51 (2.74)	5.52 (2.53)
98DAS	3.12 (2.02)	3.93 (2.21)	2.36 (1.83)	0.00 (1.00)	2.89 (1.96)	2.46 (1.81)
Mean	9.90 (1.35)	10.67 (2.48)	7.27 (3.58)	5.77 (4.33)	7.95 (2.29)	
			<b>SEm</b> ↓	<b>CD at5%</b>		
Date of Sowing			0.17	0.49		
Age of the crop			0.19	0.55		
Date of Sowing × Age of the crop			0.36	1.04		

Figures in parentheses are square root transformed values

DOS = Date of sowing

DAS = Days after sowing

**Leaf injury rating caused by pink stem borer, *Sesamia inferens*.**

The results indicated that there was significant difference in the LIR caused due to pink stem borer on crop sown at different dates of sowing (Table 2). LIR was noticed from 21 DAS to 98 DAS. Among the different dates of sowing, the crop sown at 4<sup>th</sup> week of July (28/07/2016) has recorded the maximum LIR (3.11) followed by 3<sup>rd</sup> week of July (2.99). The lowest number of LIR was recorded on 2<sup>nd</sup> week of August (1.94). The stem borer damage in terms of LIR was lowest (0.53) at 21 DAS. It has increased gradually to 0.79, 1.79,

2.59, 3.39, 4.19 and 6.06 with advance in age up to 28 DAS, 35 DAS, 42 DAS, 49 DAS, 56 DAS and 63 DAS, respectively. However, the LIR of pin holes has decreased further to 4.46, 3.79, 1.80, 1.20 and 0.93 at 70 DAS, 77 DAS, 84 DAS, 91 DAS and 98 DAS, respectively. The interaction effect between the date of sowing and age of the crop on the LIR was observed to be significant. LIR causes due to stem borer observed lowest at 21 DAS and highest at 63 DAS in all dates of sowing. The LIR was observed initially at 21 DAS and increased gradually upto 63 DAS, but later decreased from 70 DAS to 98 DAS at all dates of sowing.

**Table 2:** Leaf injury rating caused by pink stem borer, *Sesamia inferens* (on the basis of pin holes).

Age of the crop	Dates of sowing					Mean
	1 <sup>st</sup> DOS (21/07/16)	2 <sup>nd</sup> DOS (28/07/16)	3 <sup>rd</sup> DOS (4/08/16)	4 <sup>th</sup> DOS (11/08/16)	5 <sup>th</sup> DOS (18/08/16)	
21DAS	0.00 (1.00)	1.00 (1.41)	0.66 (1.27)	0.00 (1.00)	0.66 (1.27)	0.53 (1.22)
28DAS	1.00 (1.41)	1.00 (1.41)	1.00 (1.41)	0.33 (1.13)	1.00 (1.41)	0.79 (1.33)
35DAS	3.00 (2.00)	2.33 (1.80)	1.00 (1.41)	1.00 (1.41)	1.66 (1.60)	1.79 (1.65)
42DAS	3.00 (2.00)	3.00 (2.00)	2.33 (1.80)	1.66 (1.60)	3.00 (2.00)	2.59 (1.89)
49DAS	4.33 (2.30)	3.00 (2.00)	3.00 (2.00)	3.00 (2.00)	3.66 (2.15)	3.39 (2.09)
56DAS	3.66 (2.15)	5.00 (2.44)	4.33 (2.30)	3.00 (2.00)	5.00 (2.44)	4.19 (2.27)
63DAS	5.00 (2.44)	7.00 (2.82)	6.33 (2.70)	5.00 (2.44)	5.66 (2.57)	6.06 (2.65)
70DAS	5.00 (2.44)	6.33 (2.70)	4.33 (2.30)	3.66 (2.15)	4.33 (2.30)	4.46 (2.33)
77DAS	4.33 (2.30)	5.00 (2.44)	3.66 (2.15)	3.00 (2.00)	3.00 (2.00)	3.79 (2.18)
84DAS	1.00 (1.41)	3.00 (2.00)	3.00 (2.00)	1.00 (1.41)	1.00 (1.41)	1.80 (1.64)
91DAS	1.66 (1.60)	1.66 (1.60)	1.00 (1.41)	1.00 (1.41)	1.00 (1.41)	1.20 (1.50)
98DAS	1.00 (1.41)	1.00 (1.41)	1.00 (1.41)	0.66 (1.27)	1.00 (1.41)	0.93 (1.38)
Mean	2.99 (1.38)	3.11 (1.85)	2.63 (2.43)	1.94 (2.13)	2.49 (1.44)	
			<b>SEm ±</b>	<b>CD at 5%</b>		
Date of Sowing			0.07	0.21		
Age of the crop			0.08	0.22		
Date of Sowing × Age of the crop			0.005	0.05		

Figures in parentheses are square root transformed values

#### Per cent dead hearts caused by pink stem borer, *Sesamia inferens*

The results indicated that there was significant difference in the percent dead hearts caused due to pink stem borer, *Sesamia inferens* on crop sown at different dates of sowing (Table 3). Dead hearts was noticed from 28 DAS to 84 DAS.

Among the different dates of sowing, the crop sown 4<sup>th</sup> week of July (28/07/2016) has recorded the maximum per cent dead hearts (18.67 %) followed by 3<sup>rd</sup> week of July (11.11 %). The lowest per cent of dead hearts was recorded on 2<sup>nd</sup> week of August (5.60 %) followed by of 3<sup>rd</sup> week of August (7.33%). However, the extent of dead hearts was observed to be significantly higher on crop sown at 3<sup>rd</sup> week of August (7.33 %), 1<sup>st</sup> week of August (10.84 %) and 3<sup>rd</sup> week of July (11.11 %). The stem borer damage in terms of per cent dead hearts was lowest (3.35 %) at 28 DAS. It has increased gradually to 4.04 %, 9.52 %, 14.76 %, 21.20 % and 23.08 % with advance in age up to 35 DAS, 42 DAS, 49 DAS, 56 DAS and 63 DAS respectively. However, the pink stem borer damage has decreased further to 13.97 %, 4.80 % and 1.70 % at 70 DAS, 77 DAS and 84 DAS, respectively.

The interaction effect between the date of sowing and age of the crop of pink stem borer damage was observed to be significant. Stem borer damage was observed lowest at 28 DAS and highest at 63 DAS in all dates of sowing. During this period, maximum and minimum temperature, morning

and evening relative humidity, wind velocity and bright sunshine hours were observed as 30.5°C, 24.7°C, 95.4%, 83.4%, 3.6 km / hrs and 4.6 hrs / day respectively. The incidence of dead hearts was observed initially at 28 DAS and increased gradually up to 63 DAS, but later decreased from 70 DAS to 84 DAS at all dates of sowing. Similarly, Jalali and Singh (2003) [6] also studied the seasonal activity of stem borers and their natural enemies on fodder maize and Adda *et al.* (2009) [2] observed the effect of various Planting dates on the incidence and damage to maize by *Sesamia calamistis* (Hampson). Similarly, Khan (1983) [7] evaluated the safe period of sowing maize crop which could comparatively minimize the attack of maize stem borer (*Chilo partellus*). The attack of MSB remained very serious in May and June, with maximum damage of 65.58 and 71.24% on 18 May and 15 June, respectively. Muhammad and Khawaja (2002) [9], Shukla and Kumar (2005) [13] and Abid-Farid *et al.* (2007) [11] also reported that maize stem borer, *C. partellus* is most dominant and serious pest of maize, sorghum and other cereals with damage varied from 10 to 50 per cent. Similarly, Farmanullah *et al.* (2010) [5] studies on the effect of different planting dates of maize against the infestation of maize stem borer, *Chilo partellus*. The results revealed that minimum percent infestation (1.39) was recorded in plots sown in the 3<sup>rd</sup> week of July while the highest (4.82) was recorded in the plots sown in 2<sup>nd</sup> week of July.

**Table 3:** Per cent dead hearts caused by pink stem borer, *S. inferens* in different dates of sowing

Age of the crop	Dates of sowing					Mean
	1 <sup>st</sup> DOS (21/07/16)	2 <sup>nd</sup> DOS (28/07/16)	3 <sup>rd</sup> DOS (4/08/16)	4 <sup>th</sup> DOS (11/08/16)	5 <sup>th</sup> DOS (18/08/16)	
28DAS	0.00 (0.00)	7.89 (16.28)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	3.35 (6.72)
35DAS	8.97 (17.42)	8.88 (17.32)	9.53 (17.97)	0.00 (0.00)	0.00 (0.00)	4.04 (7.40)
42DAS	10.67 (19.05)	16.33 (23.82)	10.45 (18.85)	4.22 (9.71)	7.63 (16.02)	9.52 (17.59)
49DAS	10.46 (18.86)	24.89 (29.91)	16.55 (23.99)	9.66 (17.94)	12.25 (20.48)	14.76 (22.27)
56DAS	20.44 (26.86)	36.66 (37.21)	17.95 (25.02)	10.72 (19.10)	20.27 (26.75)	21.20 (27.00)
63DAS	29.98 (33.18)	33.39 (35.28)	18.36 (25.36)	18.03 (25.11)	15.64 (23.29)	23.08 (28.44)
70DAS	14.50 (22.35)	21.70 (27.71)	15.55 (23.21)	7.84 (16.23)	10.26 (18.67)	13.97 (21.65)
77DAS	4.99 (8.60)	9.83 (18.26)	9.21 (17.64)	0.00 (0.00)	0.00 (0.00)	4.80 (9.76)
84DAS	0.00 (0.00)	8.50 (16.92)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.70 (3.38)
Mean	11.11 (7.67)	18.67 (18.04)	10.84 (26.89)	5.60 (21.66)	7.33 (5.87)	
			<b>SEm<sup>±</sup></b>	<b>CD at 5%</b>		
	Date of Sowing		2.72	7.88		
	Age of the crop		2.16	6.26		
	Date of Sowing × Age of the crop		5.87	49.32		

**Population of natural enemies recorded on maize crop****Population of spider on maize crop**

Periodical observations on the incidence of spider were observed throughout the cropping period. The natural enemies revealed that the adult of spider appeared in 14<sup>th</sup> DAS. Initially the population of spider was 0.44 per plant. The highest population (2.66 per plant) was noticed at 56 DAS on crop sown at 4<sup>th</sup> week of July. During the prevailed weather parameters viz., maximum (28.6 °C) and minimum (21.7 °C)

temperature, morning (92.3%) and evening (81.4%) relative humidity, wind velocity (9.3 km/h) and bright sunshine hours (1.6 hours/day) prevailed (Table 4). Thereafter, the spider population gradually decreased reaching 0.11 per plant at 77 DAS. The adult population ranged from 0.44 to 2.22 per plant during July last week to September months (Table 4). These findings confirmed by Sardana (2006) [11] who reported that the predatory spiders and coccinellids were present throughout the crop growth during September to mid- March.

**Table 4:** Population of spider on maize crop (per plant) in different dates of sowing

Age of the crop	Dates of sowing					Mean
	1 <sup>st</sup> DOS (21/07/16)	2 <sup>nd</sup> DOS (28/07/16)	3 <sup>rd</sup> DOS (4/08/16)	4 <sup>th</sup> DOS (11/08/16)	5 <sup>th</sup> DOS (18/08/16)	
14DAS	0.66 (1.28)	0.80 (1.34)	0.76 (1.32)	0.00 (1.00)	0.00 (1.00)	0.44 (1.19)
21DAS	0.85 (1.36)	0.90 (1.38)	0.70 (1.30)	0.62 (1.27)	0.66 (1.28)	0.74 (1.32)
28DAS	0.90 (1.37)	1.06 (1.43)	0.71 (1.31)	0.60 (1.26)	0.76 (1.32)	0.80 (1.34)
35DAS	0.93 (1.39)	1.16 (1.47)	0.95 (1.39)	1.16 (1.47)	0.89 (1.37)	1.01 (1.42)
42DAS	1.63 (1.61)	1.76 (1.66)	1.73 (1.65)	1.40 (1.54)	1.20 (1.48)	1.54 (1.59)
49DAS	2.10 (1.76)	2.40 (1.84)	2.23 (1.79)	2.10 (1.76)	1.70 (1.64)	2.10 (1.76)
56DAS	2.63 (1.90)	2.66 (1.91)	2.63 (1.90)	1.31 (1.49)	1.88 (1.69)	2.22 (1.78)
63DAS	0.60 (1.26)	1.50 (1.58)	0.36 (1.16)	0.46 (1.21)	0.50 (1.22)	0.68 (1.28)
70DAS	0.30 (1.14)	0.33 (1.15)	0.23 (1.11)	0.36 (1.16)	0.36 (1.16)	0.31 (1.14)
77DAS	0.06 (1.03)	0.13 (1.06)	0.06 (1.03)	0.16 (1.07)	0.16 (1.08)	0.11 (1.05)
Mean	1.06 (1.25)	1.27 (1.38)	1.03 (1.67)	0.81 (1.53)	0.89 (1.10)	
			<b>SEm<sup>±</sup></b>	<b>CD at 5%</b>		
	Date of Sowing		0.05	0.14		
	Age of the crop		0.04	0.11		
	Date of Sowing × Age of the crop		0.002	0.01		

**Population of coccinellids on maize crop**

Periodical observations on the incidence of coccinellids were observed throughout the cropping period. The natural enemies revealed that the adult of coccinellids appeared in 35<sup>th</sup> DAS. Initially the population of coccinellids was 0.09 per plant. The highest population (2.20 per plant) was noticed at 63 DAS on crop sown at 4<sup>th</sup> week of July. During the prevailed weather parameters viz., maximum (30 °C) and minimum (24.7 °C) temperature, morning (95.4%) and evening (83.4 %) relative

humidity, wind velocity (3.6 km / hrs) and bright sunshine hours (4.6 hrs /day) prevailed (Table 5). Thereafter, the coccinellids population gradually decreased reaching 0.27 per plant at 77 DAS. The adult population ranged from 0.09 to 2.20 per plant at 35 DAS to 63 DAS (Table 5). These findings confirmed by Sardana (2006) <sup>[11]</sup> who reported that the predatory spiders and coccinellids were present throughout the crop growth during September to mid- March.

**Table 5:** Population of coccinellids on maize crop (per plant) in different dates of sowing

Age of the crop	Dates of sowing					Mean
	1 <sup>st</sup> DOS (21/07/16)	2 <sup>nd</sup> DOS (28/07/16)	3 <sup>rd</sup> DOS (4/08/16)	4 <sup>th</sup> DOS (11/08/16)	5 <sup>th</sup> DOS (18/08/16)	
35DAS	0.00 (1.00)	0.33 (1.15)	0.16 (1.07)	0.00 (1.00)	0.00 (1.00)	0.09 (1.04)
42DAS	0.50 (1.22)	0.50 (1.22)	0.16 (1.08)	0.13 (1.06)	0.16 (1.08)	0.29 (1.13)
49DAS	0.83 (1.35)	0.96 (1.40)	0.50 (1.22)	0.20 (1.09)	0.50 (1.22)	0.59 (1.26)
56DAS	1.46 (1.57)	1.53 (1.58)	0.76 (1.32)	0.86 (1.36)	1.70 (1.64)	1.26 (1.49)
63DAS	1.66 (1.63)	2.20 (1.78)	1.30 (1.51)	0.40 (1.18)	1.40 (1.54)	1.41 (1.54)
70DAS	0.16 (1.07)	1.66 (1.63)	1.46 (1.57)	0.50 (1.22)	0.60 (1.26)	0.85 (1.34)
77DAS	0.00 (1.00)	0.00 (1.00)	0.46 (1.20)	0.50 (1.22)	0.43 (1.19)	0.27 (1.12)
Mean	0.65 (1.09)	1.02 (1.18)	0.68 (1.47)	2.59 (1.48)	0.68 (1.15)	
			<b>SEM<math>\pm</math></b>	<b>CD at 5%</b>		
Date of Sowing			0.06	0.18		
Age of the crop			0.07	0.20		
Date of Sowing $\times$ Age of the crop			0.004	0.03		

Figures in parentheses are square root transformed values

DOS = Date of sowing

DAS = Days after sowing

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