

Original Research Article

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**Screening of Maize Cultivars against Maize Stem Borer
Chilo partellus (Swinhoe), under Artificial Infestation in Odisha, India**

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This study was carried out at Maize field of AICRP on Maize, Central farm, OUAT, Bhubaneswar during *kharif* 2014 and *kharif* 2015. The experiment comprised of 15 numbers of popular cultivars of maize *viz.* MRM 3777, DMH 7705, DKC9117, VIVEK HYBRID-9, VIVEK QPM-9, NMH-1247, NK-30, BIO 9681, BIO 9637, CORN S 6217, ASMH 177, HM-4, HQPM-1, HQPM -5 and DKC 8101. Among all the cultivars NK-30, Bio 9681 and ASMH 777 cultivars recorded resistant. DKC 9117, VIVEK HYBRID-9, NMH 1247, BIO9637, CORN S 6217 and DKC-8101 cultivars recorded moderately resistant. Cultivars MRM 3777, VIVEK QPM- 9, HM-4, HQPM-5 and HQPM-1 recorded susceptible. Maximum leaf scraping and pinhole per cent recorded in cultivar HQPM-1(27.43%). Dead heart formation recorded in screening experiment after thirty and forty five days of germination. Maximum dead heart formation recorded in HQPM-1(28.20%) after forty five days of germination followed by Vivek QPM-9 andHQPM-5. Where minimum dead heart formation recorded in NK-30. Leaf injury rating (LIR) recorded in thirty and forty five days germination. Minimum leaf injury rating(LIR) recorded in NK-30 with 1.89 scale and maximum leaf injury recorded in HQPM-1 with 8.91 scale.

Introduction

Maize is an important cereal crop known as “Queen of cereals” grown on approximately 140 million hectares under diverse climatic conditions worldwide. In India it is grown on 8.12 million hectares with the production and productivity of 19.70 million tones and 24.35 quintals per hectare, respectively (Ministry of

Agri & Farmers welfare, 2018). In Odisha it is grown on 2.69 lakh hectares with the production and productivity of 7.51 lakh tones and 27.90 quintals per hectare, respectively (Odisha Agriculture Statistics,2018).The average maize yield in the developed countries is more than 8t/ha, while in the developing countries it is around 3 t / ha (Zaidi and Singh, 2005). There are several biotic and abiotic

factors contributing to loss in yield. Pest causes 33% loss in which insect pest contribute 9.5%. Maize is attacked by over 250 species of insect and pests (Mathur, 1991). Of those three species of tissue borers viz., maize stem borer or spotted stem borer (*Chilo partellus* Swinhoe), pink stem borer (*Sesamia inferenze* Walkar), shoot fly (*Atherigona soccata* Rondani) are regular and serious pests of maize. Among these, maize stem borer *Chilo partellus*, is the principal pest in all maize growing countries. Maize stem borer is the serious pests of maize usually appears 10-15 days after sowing leading to a loss from 5.14 to 91.22 per cent (Singh and Sajjan, 1982). Stem borer is one of the biotic constraints in successful maize and sorghum production worldwide (James,2003), particularly in Asia and Africa (Siddiqui and Marwaha,1993).

Materials and Methods

The Experiment was conducted at Maize field of AICRP on Maize, Central farm, Odisha University of Agriculture and Technology, Bhubaneswar during *kharif* 2014 and *kharif* 2015. The experiment comprised of fifteen numbers of popular cultivars of maize viz. MRM 3777, DMH 7705, DKC9117, VIVEK HYBRID-9, VIVEK QPM-9, NMH-1247, NK-30, BIO 9681, BIO 9637, CORN S 6217, ASMH 177, HM-4, HQPM-1, HQPM -5 and DKC 8101. The experiment was laid out in Randomized Block Design (RBD) with fifteen treatments and replicated thrice. Sowing was done in well prepared land on first week of July. The total numbers of plots were forty five. The maize seeds of different fifteen cultivars were sown in plot size of 4M X 3M with plat to plant 25cm and row to row of 60cm. Each row consists of 16 maize plants and each treatment plot consists of 5 rows. Thus the experimental plot consists of 80 maize plants. When the plants were 15 days-old, 10-12 black-headed eggs of *C. partellus*

laid on butter paper were pinned in the whorl. After 30 days of germination (DAG) and 45 days after germination (DAG) plants were observed for level of infestation. Symptoms like leaf scrapping + pin hole per cent, Leaf injury rating (LIR) on 1-9 scale, and dead heart per cent were recorded. The observation were recorded on randomly selected forty plants from inner three rows of each plot, outer rows to avoid border effect. The dead hearts due to attack of stem borer were counted randomly selected ten plants, at 30DAG and 45DAG and their percentage was calculated on the basis of total plant observed. The LIR of cultivars recorded by following the AICRP on Maize guideline and categorized accordingly.

LIR Plant Symptoms

- 1 Plants showing no infestation symptom
- 2 1-2 leaves with pinholes
- 3 3-4 leaves with holes
- 4 1/3 leaves showing infestation symptoms
- 5 Half the number of the leaves with infestation symptoms
- 6 2/3 leaves with infestation symptoms and the holes becoming window
- 7 Leaves with long window and plant growth is stunted
- 8 Almost all leaves displaying heavy infestation and plant growth is stunted
- 9 Dead heart formation observed

LIR Category

- 1-3 Resistant
- >3-6 Moderately resistant
- >6-9 Susceptible

Source: Annual report of AICRP on Maize

Results and Discussion

The statistical analysis (Table 1) showed that all the tested maize cultivars had significant difference in their response to maize stem

borer *Chilo partellus* (Swinhoe). The cultivar NK-30 recorded minimum leaf scraping and pinhole per cent of 2.17 and 2.27 at 30 DAG and 45 DAG respectively, where the cultivars ASMH 777 and BIO 8681 were less preferred by *Chilo partellus* with leaf scraping and pinhole percent 3.53 and 3.57 at 30 DAG. Where 4.0 and 4.57 at 45 DAG in both the years. Maximum leaf scraping and pinhole per cent was recorded in HQPM-1 with 26.65 and 27.43 at 30 DAG and 45 DAG respectively.

Minimum leaf injury rating (LIR 1-9 scale) was recorded in NK-30 with 1.63 at 30 DAG and 2.15 at 45 DAG respectively followed by BIO 9681 with 2.75 at 30 DAG and with 3.15 at 45 DAG, ASMH 777 with 2.70 at 30 DAG and with 3.22 in both *kharif* 2014 and *kharif* 2015 at 45 DAG and statistically at par with each other at both the intervals. The maximum Leaf injury rating was recorded in HQPM-1 with 8.87 at 30 DAG and with 8.85 at 45 DAG in both the years. The cultivars NK-30, BIO 9681 and ASMH 777 were categorized resistant against maize stem borer. Where the cultivars DMH-7705, DKC 9117, VIVEK HYBRID-9, NMH 1247, BIO9637, CORN S 6217 and DKC-8101 were recorded moderately susceptible against maize stem borer. MRM 3777, VIVEK QPM-9, HQPM-1, HM-4 and HQPM-5 were recorded susceptible to *Chilo partellus* (Table 2)

The minimum dead heart per cent were recorded in NK-30 with 1.80 (30DAG) and 2.56 (45DAG) in both the years followed by ASMH 777 with 3.40(30DAG) and 4.58 (45DAG), BIO-9681 with 3.72(30DAG) and 4.55 (45DAG). The maximum dead heart per cent recorded in HQPM-1 with 25.63(30DAG)

and 28.48 (45DAG) in both the years (Table 3).

The result of the present studies was discussed in detail and the pertinent literature in support of the findings has been cited. In the applied aspects i.e., screening of the maize cultivars against *Chilo partellus* on the basis of leaf scraping and pinhole per cent, leaf injury rating and dead heart percent have been discussed in the light of earlier findings. The results of Kundu (1985) also support the present findings.

He conducted trial in Somalia on 20 maize cultivars for resistance against stem borer on the basis of leaf injury, dead hearts and stem tunnelling and identified least susceptible cultivars. Rajasekhar Lella *et al.*, (2013) reported there were no sign of dead heart was found in cultivar HUZQPM 242, HUZQPM 246, QPM 193, CM 119, AH 411, HUM 152, NMH 9858, HUZM 185, HUZM 217. Maximum occurrences of dead heart were in cultivar HUZM 227, QPM 169. Leaf damage was measured on visual rating scale. The result of Vishvendra *et al.*, (2017) also support the present findings.

They screened fifteen maize cultivars against *Chilo partellus* on the basis of dead heart percent, pest infestation and leaf injury rating and found PMH-117, BULUND and BIO-9681 cultivars recorded moderately resistant with, minimum and maximum dead hearts was recorded in PMH117 (5.33) and HYBRID MADHURI (9.66) respectively after 45 days of maize sowing which support our findings.

Table.1 Effect of *Chilo partellus* infestation on mean leaf scraping+pinhole% of different cultivars of maize

SL.No	Treatment	kharif-2014	Kharif 2015	pooled	Kkharif-2014	kharif 2015	pooled
		30DAG			45DAG		
1	MRM 3777	17.27 (4.21)	17.50 (4.24)	17.38	19.37 (4.46)	18.33 (4.34)	18.85
2	DMH-7705	8.47 (2.99)	8.47 (2.99)	8.47	9.90 (3.22)	8.97 (3.08)	9.43
3	DKC 9117	11.70 (3.49)	11.53 (3.47)	11.62	13.57 (3.75)	12.33 (3.58)	12.95
4	Vivek hy-9	17.47 (4.24)	17.53 (4.25)	17.5	19.70 (4.49)	18.10 (4.31)	18.90
5	Vivek QPM-9	21.57 (4.70)	21.57 (4.70)	21.57	24.20 (4.97)	22.57 (4.80)	23.38
6	NMH 1247	14.53 (3.88)	14.50 (3.87)	14.52	15.57 (4.01)	15.07 (3.95)	15.32
7	NK -30	2.07 (1.59)	2.27 (1.66)	2.17	2.57 (1.75)	1.97 (1.56)	2.27
8	BIO 9681	3.53 (2.01)	3.60 (2.02)	3.57	5.17 (2.38)	3.97 (2.11)	4.57
9	BIO9637	9.47 (3.16)	9.43 (3.15)	9.45	11.13 (3.41)	10.07 (3.25)	10.60
10	CORN S 6217	12.60 (3.62)	12.70 (3.63)	12.65	13.93 (3.80)	12.60 (3.62)	13.27
11	ASMH-777	3.53 (2.01)	3.53 (2.01)	3.53	4.17 (2.16)	3.83 (2.08)	4.00
12	HM-4	19.70 (4.49)	19.63 (4.49)	19.67	21.57 (4.70)	20.40 (4.57)	20.98
13	HQPM-1	26.64 (5.21)	26.67 (5.21)	26.65	28.27 (5.36)	28.14 (5.35)	28.20
14	HQPM-5	20.50 (4.58)	20.73 (4.61)	20.62	21.73 (4.71)	20.53 (4.59)	21.13
15	DKC-8101	14.73 (3.90)	14.73 (3.90)	14.73	15.47 (4.00)	15.27 (3.97)	15.37
	S.E.m(±)	0.054	0.042		0.04	0.03	
	C.D.(0.05)	0.16	0.17		0.12	0.10	

DAG- Days after Germination

Figures in parentheses are transformed $\sqrt{x + 0.5}$ means

Table.2 Effect of *Chilo partellus* infestation on mean leaf injury rating(LIR)1-9 scale of different cultivars of maize

SL.No	Treatment	kharif-2014	Kharif 2015	pooled	Kkharif-2014	kharif 2015	pooled
		30DAG			45DAG		
1	MRM 3777	6.20	6.27	6.23	6.67	6.80	6.73
2	DMH-7705	3.77	3.73	3.75	3.90	3.80	3.85
3	DKC 9117	5.40	5.47	5.43	5.80	6.83	6.32
4	Vivek hy-9	5.80	5.33	5.57	5.90	6.17	6.03
5	Vivek QPM- 9	8.27	7.93	8.10	7.97	8.37	8.17
6	NMH 1247	5.40	5.47	5.43	5.67	6.07	5.87
7	NK -30	1.67	1.60	1.63	1.80	2.50	2.15
8	BIO 9681	2.77	2.73	2.75	2.93	3.37	3.15
9	BIO9637	3.73	3.73	3.73	3.90	4.23	4.07
10	CORN S 6217	4.47	4.40	4.43	4.80	5.40	5.10
11	ASMH-777	2.70	2.70	2.70	2.90	3.53	3.22
12	HM-4	7.63	7.67	7.65	7.83	8.03	7.93
13	HQPM-1	8.70	8.93	8.87	8.73	8.97	8.85
14	HQPM-5	6.57	6.50	6.53	6.67	6.93	6.80
15	DKC-8101	5.47	5.27	5.37	6.03	6.73	6.38
	S.E.m(±)	0.116	0.142		0.194	0.271	
	C.D.(0.05)	0.34	0.43		0.58	0.80	

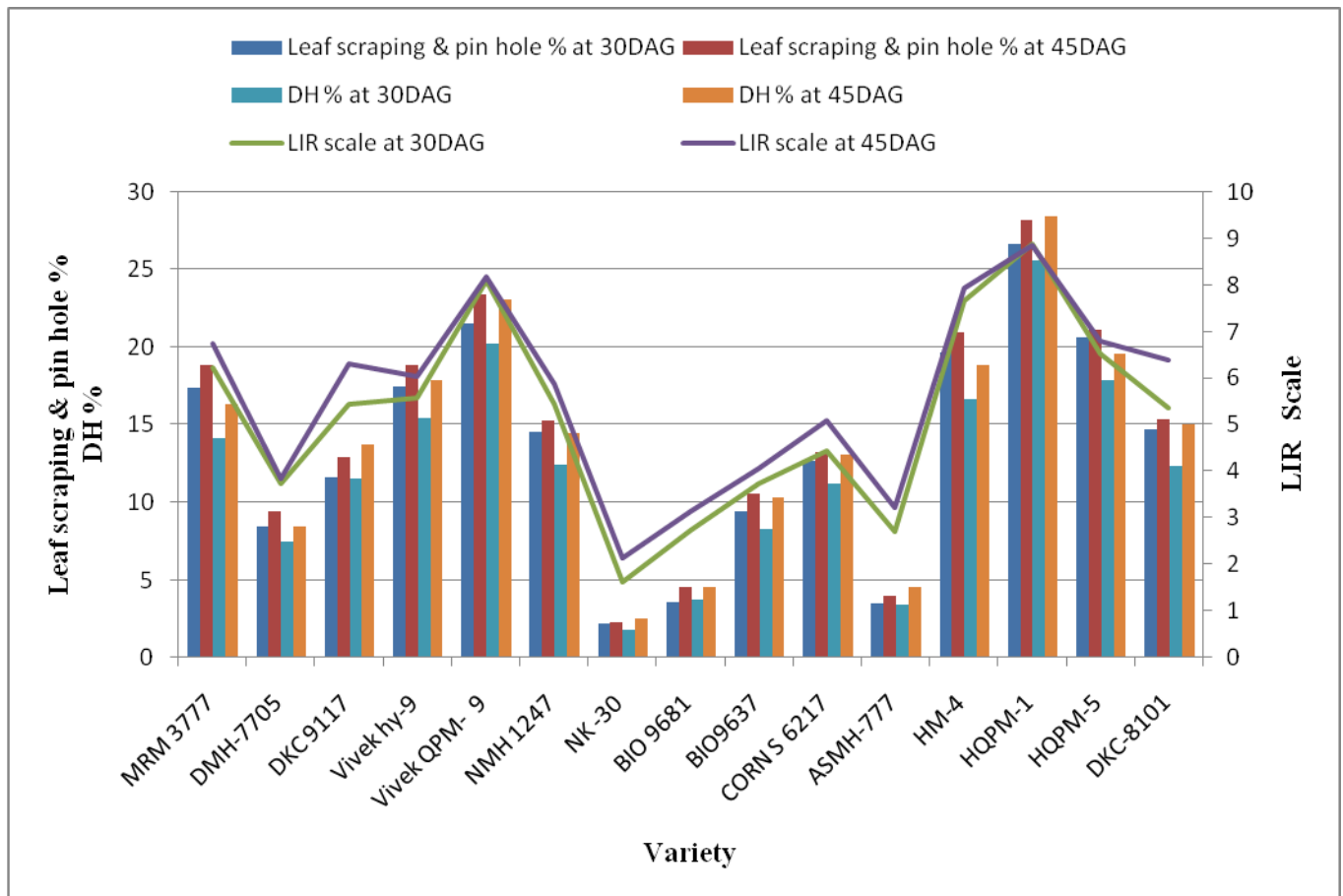
Table.3 Effect of *Chilo partellus* infestation on mean dead heart(DH)% of different cultivars of maize

SL.No	Treatment	kharif-2014	Kharif 2015	pooled	Kkharif-2014	kharif 2015	pooled
		30DAG			45DAG		
1	MRM 3777	14.47 (3.87)	13.87 (3.79)	14.17	15.83 (4.04)	16.80 (4.16)	16.32
2	DMH-7705	7.67 (2.86)	7.33 (2.80)	7.50	8.17 (2.94)	8.77 (3.04)	8.47
3	DKC 9117	11.33 (3.44)	11.73 (3.50)	11.53	13.23 (3.71)	14.23 (3.84)	13.73
4	Vivek hy-9	15.13 (3.95)	15.80 (4.04)	15.47	17.37 (4.23)	18.43 (4.35)	17.90
5	Vivek QPM- 9	20.27 (4.56)	20.20 (4.55)	20.23	22.53 (4.80)	23.73 (4.92)	23.13
6	NMH 1247	12.40 (3.59)	12.40 (3.59)	12.40	14.07 (3.82)	14.93 (3.93)	14.50
7	NK -30	1.67 (1.47)	1.93 (1.56)	1.80	2.53 (1.74)	2.58 (1.76)	2.56
8	BIO 9681	3.57 (2.02)	3.87 (2.09)	3.72	4.27 (2.18)	4.83 (2.31)	4.55
9	BIO9637	8.50 (3.00)	8.13 (2.94)	8.32	9.97 (3.23)	10.70 (3.35)	10.33
10	CORN S 6217	11.27 (3.43)	11.23 (3.42)	11.25	13.00 (3.67)	13.27 (3.71)	13.13
11	ASMH-777	3.20 (1.92)	3.60 (2.02)	3.40	4.20 (2.17)	4.97 (2.34)	4.58
12	HM-4	16.83 (4.16)	16.53 (4.13)	16.68	18.53 (4.36)	19.27 (4.45)	18.90
13	HQPM-1	25.67 (5.11)	25.60 (5.11)	25.63	28.13 (5.35)	28.83 (5.42)	28.48
14	HQPM-5	18.20 (4.32)	17.60 (4.25)	17.90	19.23 (4.44)	19.93 (4.52)	19.58
15	DKC-8101	12.27 (3.57)	12.47 (3.60)	12.37	14.40 (3.86)	15.73 (4.03)	15.07
	S.E.m(±)	0.045	0.085		0.041	0.032	
	C.D.(0.05)	0.13	0.25		0.13	0.09	

DAG- Days After Germination

Figures in parentheses are transformed $\sqrt{x + 0.5}$ means

Fig.1 Screening of maize cultivars on the basis of leaf scraping per cent, leaf injury rating (LIR) and dead heart (DH) per cent at 30DAG and 45DAG due to *Chilo partellus*(Swinhoe) during *kharif* 2014 and *kharif* 2015



The present findings also upload the view of Kakar *et. al.*, (2003) who reported that the maize cultivars i.e. local, Sadaf, Sultan and Akbar shown resistant against maize stem borer Anuradha (2012) screened 145 maize inbreds against maize stem borer on the basis of leaf injury rating add dead heart per cent and categorized as resistant.

Swami and Bajpai *et al.*, (2006) screened eight selected maize varieties against maize stem borer only Parbhat and Mahi Dhawal were found relatively resistant against this pest with mean dead hearts (19.97 and 26.26 %). In our case NK-30 recorded minimum leaf injury and pinhole percent, Leaf injury rating and dead heart percent 2.17, 1.63 and 1.80 at 30DAG

and 2.27, 2.15 and 2.56 at 40 DAG respectively, leaf injury rating 1.63 at 30DAG and 2.15 at 45DAG and minimum dead heart per cent 1.80 (30DAG) and 2.56 (45DAG) respectively followed by ASMH 777 and BIO 9681 and recorded as resistant against maize stem borer. Where DMH-7705, DKC 9117, VIVEK HYBRID-9, NMH 1247, BIO9637, CORN S 6217 and DKC-8101 recorded as moderately resistant and the maize cultivars MRM 3777, VIVEK QPM 9, HM-4, HQPM-1 and HQPM-5 recorded as susceptible against maize stem borer (Fig 1).

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