



Screening of Maize Genotypes against Maize Stem borer, *Chilo partellus* (swinhoe)

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ABSTRACT

A total of 55 maize genotypes obtained from Regional Maize Research Center (RMRC) Dharwad, Karnataka including with a resistant check, DHM 117 and a susceptible check, 30v92 were screened against stem borer, *Chilo partellus* during *kharif* 2013 under natural field conditions. Among these, 22 genotypes including checks were selected for further screening during *rabi* 2013-14 & 2014-15. Among the 20 maize genotypes, fifteen exhibited a damage score of 1.2 to 2.2, where ST X BM 254-1 (1.2), Dhk 12 X 5321 (1.3), ST X BM 32 (1.3), ST X 5422 (1.3), ST X BM 258-1 (1.4) and ST X BM 59-3(1.4) were designated as resistant. The remaining genotypes P3596, Dhk 12 X CM 1504, DHM 117, Dhk 12 X CM 142, ST X 5311, ST X 5416, ST X BM 254-3 and Dhk 12 X CM 151 were moderately resistant ranging from 1.6 to 1.8. The genotypes ST X BM 59-1(1.9) and P3396 (2.2) are designated as intermediate resistant. The highest intensity of damage was recorded in susceptible check 30v92 (3.5) which was followed by Dhk X CM 135 (3.0), ST X RNBL 4611 (2.8), Dhk 12 X CM 213, Dhk 12 X CM 138 (2.5) and Dhk 12 X 5304 (2.3) which were designated as susceptible to stem borer, *C. partellus*.

Key words: *Chilo partellus*, Maize genotypes, Screening.

In India, maize is the third most important crop after rice and wheat and is used as the food. It is a multipurpose crop, providing the most important ingredient of cattle fodder and poultry feed (Chaudhary, 1983). In India it is grown in an area of 8.67 m.ha with an annual production and productivity of 21.60 m.t and 2492 kg ha⁻¹, respectively. In Andhra Pradesh, it is cultivated in an area of 833 thousand hectares with a production of 3658 thousand tonnes and 4234 kg ha⁻¹ productivity (www. Indiatat.com).

The major obstacles in the enhancement of maize yields are the biotic and abiotic factors. In biotic factors, diseases and pests contribute maximum yield loss and prevent yield advancement in maize. It is reported that the pest attack on maize will be more in changing climate scenario. Among the insect pests, maize stem borer, *Chilo partellus* (Swinhoe) and pink borer, *Sesamia inferens* (Walker) are the most destructive ones. Almost 75 per cent of the crop loss occurs due to attack of maize stem borer (Karimullah *et al.*, 1986 and Moyal, 1998). Grain yield losses were reported to be 0.4 to 35.4% in various maize cultivars under borer infestation (Panwar *et al.*, 2001).

Though the insect pests can be controlled by application of insecticides having new mode of action but the cost involved is very high. A genotype possessing in-built resistance to the pest will be preferred to its manifold advantages like, low input cost, avoidance of pesticide cost besides eliminating residue problems and environmental pollution, so that promising genotypes could further be used in breeding programme for development of resistant varieties. Use of resistant varieties has been one of the promising methods of pest management in maize (Ortega *et al.*, 1980 and He *et al.*, 2004). In the present study, maize genotypes were screened for resistance to stem borer, *C. partellus*.

MATERIAL AND METHODS

The experiment was conducted at Agricultural College farm, Bapatla, Guntur, during three seasons *kharif* 2013, *rabi* 2013-14 and *rabi* 2014-15. Fifty one maize inbred lines and four commercial hybrids were screened against stem borers. The maize inbred lines were obtained from the Regional Maize Research Center, Dharwad, Karnataka and the hybrids were obtained from M/s Pioneer Hybrid Seeds India Ltd, Hyderabad.

Preliminary Screening Trial

Fifty five maize genotypes including two check hybrids *i.e.*, resistant check, DHM 117 and susceptible check, 30v92 were sown during *kharif* 2013 to screen the resistance levels against maize stem borer, *C. partellus* in field under unprotected natural conditions in a Randomized Block Design with two replications. Each genotype was accommodated in two rows followed by the check. The length of each line was 5.0 m and the row to row and plant to plant distances were kept as 60 cm and 30 cm, respectively. The observations were recorded on intensity of damage.

Final Screening Trial

Based on preliminary screening results, 22 genotypes including checks were further screened during *rabi*, 2013-14 and 2014-15 (Table 1). The experiment was conducted in Randomized Block Design with two replications as mentioned above. Data was recorded using five-classes rating scale which can accurately differentiate among the tested genotypes for resistance.

Intensity of damage

Five-classes rating scale was developed by Khamis *et al.*, 2013 to evaluate the intensity of damage caused by attack of stem borers.

The description of this scale is as follows:

Class 1: No visible injury on plants (no symptoms)

Class 2: Plants with holes less than 1mm diameter (pin holes)

Class 3: Several leaves with relatively larger round/elongated holes

Class 4: Plants with relatively larger round/elongated irregular holes, distortion of leaves (most leaves have long holes), accumulation of green pellets of frass in the whorl or on the ground around the stem.

Class 5: Plants with dead hearts.

The intensity of damage (ID) was calculated as follows:

$$ID = \frac{\sum ID_i}{N}$$

Where "N" is the number of inspected plants. Genotypes were classified according to their ID into:

*Resistant, (R) (less than 1.5),

*Moderately Resistant.(MR)(1.5 to less than 1.9),

*Intermediate, (IR) (1.9 to less than 2.3),

*Susceptible, (S) (2.3 to less than 2.7) and

*Highly Susceptible, (HS) (more than 2.7).

RESULTS AND DISCUSSION

Preliminary Screening

Fifty five maize genotypes including two check varieties were sown during *kharif* 2013 to screen the resistance levels against maize stem borer, *C. partellus* in field under unprotected natural conditions in a Randomized Block Design with two replications. Field screening of maize genotypes showed that there were significant difference between the cultures and the results were presented in table 1.

Intensity of Damage

There were significant differences among various maize genotypes in respect of susceptibility to stem borer, *C. partellus*. The intensity of damage (1-5 scale) to maize genotypes ranged from 1.1 to 2.8 (Table 1). Among the fifty five genotypes tested, twenty genotypes showed the lowest intensity of damage ranging from 1.1 to 1.4 and were designated as resistant to the maize stem borers. Twenty two genotypes with a damage score ranging from 1.5 to 1.8 falls under the category of moderately resistant and six genotypes were intermediately resistant ranging from 1.9 to 2.2. Remaining genotypes with a damage score of 2.3 to 2.8 were designated as susceptible genotypes to stem borers. Among the twenty resistant genotypes the lowest damage score was recorded in ST X BM 254-1, Dhk-12 X CM 142, Dhk-12 X CM 213 with 1.1 ID. The highest damage score was recorded in ST X BM127-IR (2.8) followed by 30v92 (2.6) and ST X 5418- IR (2.6).

Intensity of damage during *rabi* 2013-14

Field Screening of maize genotypes against stem borers during *rabi* 2013-14 showed that there are significant differences between the genotypes in the intensity of damage, which ranged from 1.2 to 3.6 (Table 2). Out of 22 genotypes screened against stem borers, 17 genotypes exhibited a damage score in between 1.2 to 2.0 and were designated as resistant to stem borer, *C. partellus*.

Table 1. Selected maize genotypes for final screening against stem borers during *rabi* 2013-14 & 2014-15.

S.No	Genotype	Reaction
1	Dhk-12X5311-IR	R
2	Dhk-12X CM 142 – IR	R
3	STXBM59-3-IR	R
4	Dhk-12 X CM 151- IR	R
5	STXBM254-1-IR	R
6	Dhk-12X5321-IR	R
7	Dhk-12X 5304-IR	IR
8	STX5416-IR	R
9	STXBM258-1-IR	MR
10	STXBM32-IR	R
11	STXRNBL-4611-IR	IR
12	STXBM254-3-IR	R
13	STXBM59-1-IR	R
14	Dhk-12 X CM 138- IR	MR
15	Dhk-12 X CM 135 – IR	R
16	Dhk-12 X CM 213- IR	R
17	STX 5422-IR	R
18	Dhk-12 X CM 1504 – IR	IR
19	P3596	R
20	P3396	MR
21	30v92 (S check)	S
22	DHM117(R check)	MR

Remaining genotypes with a damage score greater than 2.0 have been designated as susceptible to maize stem borers. Among the 17 genotypes, ST X BM 254-1 (1.2), Dhk 12 X 5321 (1.3), ST X 5422 (1.3), ST X BM 59-3 (1.4) and ST X BM 32 (1.4) are found to be resistant, where as the resistant check, DHM 117 recorded 1.7 and was designated as moderate resistant. The remaining cultures with a damage score between 1.5 to 2.0 were designated as moderate and intermediate resistant genotypes. The highest intensity of damage was recorded in 30v92 (3.6) followed by Dhk 12 X CM 135 (2.7) and were designated as highly susceptible.

Intensity of Damage during *rabi* 2014-15

Field screening of maize genotypes against stem borer, *C. partellus* during *rabi* 2014-15 showed that there was significant differences between the genotypes in the intensity of damage which ranged from 1.0 to 3.4 (Table 2). Out of 22 genotypes screened against stem borers, 16 genotypes exhibited a damage score in between 1.0

to 1.8 and were designated as resistant to stem borers. Among the 16 genotypes, seven were found to be resistant (ST X BM 258-1, ST X BM 254-1, ST X BM 32, ST X BM 59-3, Dhk 12 X 5321, ST X 5422 and ST X 5311 ranging from 1.0 to 1.4. The genotypes P3596, Dhk 12 X CM 1504, DHM 117, ST X 5416, Dhk 12 X CM 142, ST X BM 254-3, ST X BM 59-1 and Dhk 12 X CM 151 were found to be moderately resistant with damage rating from 1.5 to 1.8. The remaining genotypes Dhk 12 X 5304, Dhk 12 X CM 213, Dhk 12 X CM 138, ST X RNBL 4611 and 30v92 were designated as susceptible ranging from 2.3 to 3.4.

Pooled means of intensity of damage for maize genotypes against Stem borers during *rabi* 2013-14 and *rabi* 2014-15.

The overall mean of damage scores of maize genotypes in both the seasons also showed similar trend. The intensity of damage was in a range of 1.2 to 3.5. Out of 22 genotypes screened against stem borers, fifteen exhibited a damage

Table 2. Preliminary screening of maize genotypes against *C. partellus* during Kharif 2013.

Entry	Genotypes	Intensity of Damage	Reaction
1	Dhk-12X5301-IR	1.5	MR
2	Dhk-12X5302-IR	1.6	MR
3	Dhk-12X5303-IR	2.3	S
4	Dhk-12X5304-IR	2.0	IR
5	Dhk-12X5305-IR	1.5	MR
6	Dhk-12X5306-IR	1.4	R
7	Dhk-12X5311-IR	1.2	R
8	Dhk-12X5312-IR	1.5	MR
9	Dhk-12X5316-IR	1.3	R
10	Dhk-12X5318-IR	1.7	MR
11	Dhk-12X5321-IR	1.3	R
12	Dhk-12X5323-IR	2.3	S
13	Dhk-12X5330-IR	1.3	R
14	Dhk-12X5336-IR	1.4	R
15	Dhk-12X5337-IR	1.6	MR
16	Dhk-12X5339-IR	2.2	IR
17	STxBM24- IR	1.6	MR
18	STxBM32- IR	1.3	R
19	STxBM36- IR	2.2	IR
20	STxBM59- 1-IR	1.2	R
21	STxBM59-2-IR	2.4	S
22	STxBM59-3-IR	1.2	R
23	STxBM60-IR	1.8	MR
24	STxBM127	2.8	HS
25	STxBM253	1.4	R
26	STxBM254-1	1.1	R
27	STxBM254-2	1.8	MR
28	STxBM254-3	1.2	R
29	STxBM258-1	1.5	MR

score of 1.2 to 2.2 and were designated as resistant (Table 3). Among the 15 cultures, ST X BM 254-1 (1.2), Dhk 12 X 5321 (1.3), ST X BM 32 (1.3), ST X 5422 (1.3), ST X BM 258-1 (1.4) and ST X BM 59-3 (1.4) were designated as resistant. The remaining genotypes P3596, Dhk 12 X CM 1504, DHM 117, Dhk 12 X CM 142, ST X 5311, ST X 5416, ST X BM 254-3 and Dhk 12 X CM 151 were moderately resistant ranging from 1.6 to 1.8. The genotypes ST X BM 59-1 (1.9) and P3396 (2.2) are designated as intermediate resistant. The highest intensity of damage was recorded in susceptible check 30v92 (3.5) which was followed by Dhk X CM 135 (3.0), ST X RNBL 4611 (2.8), Dhk 12 X CM 213, Dhk 12 X CM 138 (2.5) and Dhk 12 X 5304 (2.3) which were designated as susceptible to stem borer.

Several researchers Thakur *et al.* (2012), Chandra *et al.* (2012), Sekhar *et al.* (2008) and Chavan *et al.* (2007) also screened maize cultivars against stemborers in the similar way. The results are in agreement with Khamis *et al.* (2013), but the cultivars tested were different as those of studied in the present experiment. They reported that the most susceptible cultivars recorded the intensity damage score of 2.44 compared to tolerant variety (1.85). Similar trend was observed with Muniyiri *et al.* (2013) who reported the leaf index of 0.6 in the resistant genotype compared to the susceptible (1.7). The data revealed that ST X BM 254-1, Dhk 12 X 5321, ST X BM 32 and ST X BM 59-3 genotypes showed resistant reaction in both seasons

Table 3. Screening of maize genotypes against maize stem borers during two successive seasons.

Entry	Genotype	Intensity of Damage (ID)	Reaction	Intensity of Damage (ID)	Reaction	Pooled mean of two seasons	Reaction
		<i>rabi</i> 2013-14		<i>rabi</i> 2014-15			
1	Dhk 12X5311 IR	2.0	IR	1.4	R	1.7	MR
2	Dhk 12X CM142	1.7	MR	1.7	MR	1.7	MR
3	STXBM 59 3	1.4	R	1.3	R	1.4	R
4	Dhk-12 X CM 151	1.8	MR	1.8	MR	1.8	MR
5	STXBM 254-1	1.2	R	1.1	R	1.2	R
6	Dhk-12X 5321	1.3	R	1.3	R	1.3	R
7	Dhk-12 5304	2.2	IR	2.3	S	2.3	S
8	STX 5416	1.8	MR	1.7	MR	1.8	MR
9	STX BM 258-1	1.7	MR	1.0	R	1.4	R
10	STX BM 32	1.4	R	1.2	R	1.3	R
11	STX RNBL 4611	2.7	S	2.9	HS	2.8	HS
12	STX BM 254-3	1.7	MR	1.8	MR	1.8	MR
13	STX BM 59-1	1.9	IR	1.8	MR	1.9	IR
14	Dhk-12 X CM 138	2.4	S	2.6	S	2.5	S
15	Dhk-12 X CM 135	2.7	HS	3.2	HS	3.0	HS
16	Dhk-12 X CM 213	2.5	S	2.5	S	2.5	S
17	STX 5422	1.3	R	1.3	R	1.3	R
18	Dhk-12 X CM 1504	1.8	MR	1.6	MR	1.7	MR
19	P3596	1.6	MR	1.5	MR	1.6	MR
20	P3396	2.2	IR	2.2	IR	2.2	IR
21	30V92 (S)	3.6	HS	3.4	HS	3.5	HS
22	DHM 117 (R)	1.7	MR	1.7	MR	1.7	MR
	SEm(±)	0.22		0.19		0.12	
	CD (0.05)	0.64		0.55		0.36	
	CV(%)	15.89		14.13		9.20	

as well as in the Pooled mean data and hence these lines can be further used in breeding programmes for evolving stem borer resistant varieties.

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