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MAIZE INBREDS TOLERANT TO TISSUE BORERS, *CHILO PARTELLUS* AND *ATHERIGONA* SPP.

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ABSTRACT

Forty three inbred lines were evaluated against maize stalk borer, *Chilo partellus* (Swinhoe) under artificial infestation during *kharif* (rainy) season and under heavy natural infestation against shoot fly species (*Atherigona soccata* Rondani and *A. naqvii* Steyskal) during spring season. The persual of data reveals that two inbreds namely, IPA 34 - 10 - 13 - 3 - 1 - 1 - # - 2 - 1 and IPA 3 - 6 - 14 - 2 - # - 1 were least vulnerable to both the tissue borers, *C. partellus* and *Atherigona* spp. These inbreds may be designated as multiple pest resistant sources and should be used while developing varieties or single/double cross hybrids.

Key Words : *Atherigona soccata, A. naqvii, Chilo partellus,* maize, resistance

One of the limiting factors for successful cultivation of maize in *kharif* season in different agro-climatic zones of the country is serious damage done by maize stalk borer, *Chilo partellus* (Swinhoe) and in spring season by shoot fly species (*Atherigona soccata* Rondani and *A. naqvii* Steyskal). The losses in grain yield due to *C. partellus* had been reported in the range of 24.3 to 36.3 per cent [1]. The shoot fly is also becoming a serious pest in spring sown maize [5]. In view of this heavy economic loss, it becomes imperative to develop high yielding varieties/hybrids possessing good level of resistance to these pests. In the past, emphasis had been mainly on screening of experimental or ready-to-release maize varieties for resistance to stalk borers. Such a procedure, in fact, remained ineffectual in improving the stalk borer resistance levels in the end- products. Keeping this in view, the promising advanced stage inbreds which were advanced under heavy natural infestation in early stages of their development, were subjected to artificial infestation by *C. partellus* and heavy natural infestation by *Atherigona* spp. in the present investigations.

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MATERIALS AND METHODS

Forty three selected inbreds along with resistant check (Antigua Gr.I) were sown on 8th July, 1996 in a randomized block design during *kharif* season. Each row was 5 m long and formed one plot replicated twice. Row to row and plant to plant distance was kept at 75 and 20 cm, respectively. When the plants were 14-15 days old, 20-25 eggs (black-head stage) of *C. partellus* were introduced in the whorls of 10 plants in each replication. The hatching was observed to be 90-95 per cent. The leaf damage data were recorded 30 days after the insect release. The plants were rated on leaf injury rating scale 1-9 [4]. The means of leaf injury damage recorded in each replication of different germplasms were transformed to scores according to interploted values for ranked data [3] and subjected to analysis of variance.

The same set of inbreds was sown on 28th February, 1997 in a randomized block design during spring season. One row of 3 m long of each germplasm constituted one plot and was replicated thrice. The distance between rows was 60 cm whereas only 20 cm between plants. Seeds germinated after 11 days of sowing. The dead-hearts caused by shoot flies were counted in 25 days old crop in various maize lines. The dead-hearts were converted into per cent dead- hearts based on total number of plants. The dead-heart percentages were transformed by using sine inverse [2] and then subjected to analysis of variance.

RESULTS AND DISCUSSION

It is apparent from Table 1 that various inbreds differed significantly among themselves in relation to leaf injury damage. The leaf injury rating ranged from 3.6 to 8.5 on rating scale 1-9. On the basis of leaf damage caused by *C. partellus*, the inbreds *viz.*, IPA 34 - 10 - 13 - 3 - 1 - 1 - # - 2 - 1, IPA 21 - 10 - f - # - 2, IPA 3 - 6 - 14 - 2 - # - 1, IPA 21 - 10 - 19 - 2 - # - 3, FSA 17 - 2 - 1 - # - 1 , FSA 6 - 4 - # - 1, FSA 6 - 4 - # - 2, IPA 1 - f - # - 2, IPA 23 - 92 - f - # and IPA 18 - 2- 2 - f - # - 2 were found least susceptible under artificial infestation and showed leaf injury rating below 5 during *kharif* season. Also, there were significant differences among inbreds with regard to their susceptibility to shoot fly species (*A. soccata* Rondani and *A. naqvii* Steyskal). The percentage dead-heart ranged from 8.1 to 38.8 in different inbreds. The inbreds tolerant to shoot fly species were IPA 3 - 20 - f - # - # - 1, IPA 34 - f- 106 - 2- 2, IPA 34 - 10 - 13 - 3 - 1 - 1 - # - 2 - 1, and IPA 3 - 6 - 14 - 2 - # - 1. The dead-heart formation in these inbreds was recorded below ten per cent.

Table 1. Comparative tolerance of elite maize inbred lines against tissue borers, *C. partellus* during *kharif* and *Atherigona spp* during spring season

S. No.	Pedigree	Mean leaf injury score per plant*		Mean per cent dead - heart	
		Original	Transformed	Original	Transformed
1.	IPA 34-62-f-#-#	8.1	+0.958	18.4	25.34
2.	IPA 3-20-f-#-#-1	7.3	+0.660	9.9	18.31
3.	IPA 3-20-f-#-#-2	7.2	+0.624	12.2	20.12
4.	IPA 3-20-f-#-#-3	7.1	+0.588	20.9	27.06
5.	IPA 29-3-5-1-#-#-6	5.8	+0.203	38.1	38.08
6.	IPA 44-6-13-2-1-#-#-1	7.1	+0.588	18.4	25.34
7.	IPA 44-6-13-2-1-#-#-2	6.6	+0.435	26.7	30.90
8.	IPA 40-85-f-#-#-1	6.4	+0.375	38.2	38.17
9.	IPA 40-85-f-#-#-2	8.5	+1.182	10.4	18.72
10.	IPA 40-85-f-#-#-3	8.4	+1.126	32.1	34.44
11.	IPA 34-f-106-2-1	6.1	+0.285	38.8	38.50
12.	IPA 34-f-106-2-2	5.7	+0.176	8.1	16.51
13.	IPA 2-2-f-#-1	6.2	+0.315	11.3	18.86
14.	IPA 2-2-f-#-2	6.7	+0.465	26.8	31.17
15.	IPA 34-10-13-3-1-1-#-2-1	4.6	–0.122	8.1	16.48
16.	IPA 34-10-13-3-1-1-#-2-2	5.5	+0.122	17.8	24.91
17.	IPA 21-10-f-#-1	5.0	–0.014	13.4	20.78
18.	IPA 21-10-f-#-2	4.8	–0.068	32.1	34.48
19.	IPA 9-7	5.2	+0.041	17.1	24.41
20.	IPA 3-6-14-2-#-1	4.9	–0.041	8.4	16.84
21.	IPA 3-6-14-2-#-2	5.1	+0.014	11.5	19.78
22.	IPA 3-6-14-2-2-#-3	6.7	+0.465	17.2	24.39
23.	IPA 34-6-f-2-#-1	5.7	+0.176	24.7	29.25
24.	IPA 34-6-f-2-#-2	5.5	+0.122	20.2	26.26
25.	IPA 22-6-#-10	5.6	+0.149	16.8	24.18
26.	IPA 21-10-19-2-#-1	4.9	–0.041	18.8	25.35
27.	IPA 21-10-19-2-#-2	6.0	+0.257	28.6	31.57
28.	IPA 21-10-19-2-#-3	4.8	–0.068	23.6	29.06
29.	FSA 17-2-2-#-1	5.7	+0.176	13.9	21.79

(Table contd.)

S. No.	Pedigree	Mean leaf injury score per plant*		Mean per cent dead - heart	
		Original	Transformed	Original	Transformed
30.	FSA 17-2-2-#-2	5.3	+0.068	13.4	21.46
31.	FSA 5-9-#-(W)-1	6.8	+0.525	16.8	24.03
32.	FSA 5-9-#-(W)-2	5.5	+0.122	22.7	28.23
33.	FSA 17-2-1-#-1	3.6	–0.405	35.4	36.50
34.	FSA 17-2-1-#-2	5.8	+0.203	18.7	25.48
35.	FSA 17-2-1-#-3	5.3	+0.068	29.6	32.92
36.	FSA 6-4-#-1	4.7	–0.095	25.9	30.53
37.	FSA 6-4-#-2	4.6	–0.122	33.3	35.24
38.	FSA 6-4-#-3	5.7	+0.176	24.6	29.33
39.	IPA 1-f-#-1	5.5	+0.122	26.5	30.44
40.	IPA 1-f-#-2	4.9	–0.041	23.6	29.06
41.	IPA 23-92-f-#	4.8	–0.068	22.5	28.15
42.	IPA 18-2-2-f-#-1	5.7	+0.176	12.2	20.33
43.	IPA 18-2-2-f-#-2	4.5	–0.149	14.6	22.41
44.	Antigua Gr.I	4.1	–0.257	25.0	29.98
F test			Sig.		Sig.
S.Em. ±			0.016		3.422
C.D. at 5 per cent			0.045		9.77

IPA - Inbred parent Delhi; FSA -- Full-sib parent Delhi.
*Maximum possible leaf injury score per plant is 9.

It can be deduced from the Table 1 that two inbreds *viz.,* IPA 34 - 10 - 13 - 3 - 1 - 1 - # - 2 - 1 and IPA 3 - 6 - 14 - 2 # - 1 were tolerant to both the tissue borers, *C. partellus* and *Atherigona* spp. and were comparatively less vulnerable to the attack of these borers. Hence, these inbreds can be designated as multiple borer resistant inbreds which will immensely help in developing new varieties/hybrids to enhance the production in *kharif* as also in spring season.

The persual of yield data in other trials reveals that most of the inbred lines which have shown resistance to one or the other or both pests also possessed quite high yielding potential which ranges from 2.2 t/ha to 3.2 t/ha.Inbreds IPA 34 - 10 - 13 - 3 - 1 - 1 - # - 2 - 1 and IPA 3 - 6 - 14 - 2 - # - 1 have yielded 2.9 and 2.5

t/ha, respectively. Siddiqui *et al.*, [6] have also demonstrated that higher the resistance level in inbreds is likely to result in higher level of resistance in the resultant variety/hybrid. Attempts towards the elevation of level of resistance through population improvement have been rather discouraging. The magnitude of additive genetic variance controlling resistance has been found to be of low degree as a result of which the population improvement procedure did not lead to any significant appreciation in both level of additive genes as well as level of resistance. Very few sources of resistance have been discovered and most the polygenic in nature having different degrees of dominance. Thus, efforts for their direct incorporation in the inbred lines for the development of resistant single cross hybrids have also not been very successful. The present work, therefore, supplies the much needed alternate inbred line sources of resistant genes to achieve higher levels of resistance resulting from heterosis for resistance in new single cross hybrids. The inter-disciplinary approach right from the inception of the programme may lead to the desired goals in this regard.

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