SCREENING OF SOME SORGHUM LINES FOR SINGLE AND MULTIPLE RESISTANCE TO SORGHUM SHOOTFLY, *ATHERIGONA SOCCATA* ROND. AND STEM BORER, *SESAMIA CRETICA* LED. UNDER FIELD CONDITIONS IN SOHAG GOVERNORATE, UPPER EGYPT

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Abstract: Twenty-five sorghum lines were tested for their resistance to two major pests of sorghum the shootfly, *Atherigona soccata* Rond. and the stem borer, *Sesamia cretica* Led. under field conditions in Sohag governorate during 2000 and 2001 seasons. All the tested lines were considered resistant to shootfly except the PB15925 line which showed moderate resistance. Also, all the tested lines were found to be resistant against stem borer infestation. Among these tested lines IS 2205, PB15621-1-2-2, PB15833-1-1, ICSV 700 and local had less than 10% infestation, while the rest lines had less than 20% infestation. Concerning the resistance to both insects, the two lines PB15925 and ICSV 93093 showed moderate susceptibility, while the remaining lines were considered of moderate resistance. Thus, these lines could be used profitably in breeding programme. The yield of sorghum lines negatively correlated with the percentage of infestation by the two pests. CSH1 gave the highest yield, while PB15925 line gave the lowest yield.

Introduction

Sorghum is considered one of the most important cereal crops in upper Egypt, especially Sohag governorate. In recent years, great efforts have been managed to improve its productivity to cover the continuous in demand for local consumption.

Sorghum is extensively damaged at different stages of growth by different insect species. Among the most serious insect species recorded in many parts of the world including Egypt were the sorghum shootfly, *Antherogena soccata* Rondani and the stem borer, *Sesamia cretica* Led.

Excessive chemical control for these pests increase the cost of pest management programme and brought many problems such as, environmental pollution, emergence

of new pests, pesticide resistance and threat of human health. So, it is necessary to develop new varieties or hybrids which possess resistance to these pests. In Egypt, most of the recently released varieties and hybrids are susceptible to insect attack and their yield potential depends on pests control by using insecticides. Most sorghum growers cannot afford costly insecticides. This situation needs a greater awareness for the development and use of resistant varieties of sorghum to reduce the cost of cultivation and to improve and stabilize the productivity. Efforts to breed for resistance to one kind of insect species are becoming infelicitous, since the genotype remains vulnerable to one or the other insect pest. Thus, a feasible solution lies in developing varieties possessing multiple resistance. Some investigators developed new varieties or hybrids which possess resistance to sorghum shootfly, *A. soccata* (Blum, 1967; 1971; Jotwani *et al.*, 1970; 1971a,b; Rao, 1972; Dalavi, 1975; Venugopal *et al.*, 1975; Rao *et al.*, 1978; Singh *et al.* 1978; Jadhav and Jadhav 1979; Mote *et al.* 1981; Salman 1995; Newanze *et al.* 1998 and El-Saadany *et al.* 1999) and stem borer, *S. cretica* (Singh *et al.* 1968; Sharma *et al.* 1977; Reddy 1985; Salman 1995 and 2001).

The present work was conducted to study the single and multiple resistance of some lines of sorghum to sorghum shootfly and stem borer infestations under field conditions in Sohg governorate, Upper Egypt.

Materials and Methods

The present investigation was carried out at the Experimental Farm of Faculty of Agriculture, Sohag, South Valley University during the period from July to October of 2000 and 2001 seasons. The experimental area was 1/4 feddan and divided into 75 equal plots 1/400 feddan each. Every plot consisted of 6 rows and 60 cm apart was selected. Twenty-five advanced sorghum lines were obtained from International Crops Research Institute for the semi-arid tropics (ICRISAT), Patancheru P.O., Andhra Pradesh 502324, India. The lines used were, IS 2205; IS 18551; PB 14390-4; PB 14844-1; PB 15157-4-1-2; PB 15520-2-2-2; PB 15438; PB 15621-1-2-2; PB 15828-2H; PB 15833-1-1; PB 15833-3-1H; PB 15856; PB 15881-3; PB 15925; ICSV 93087; ICSV 93088; ICSV 93089; ICSV 93090; ICSV 93091; ICSV 93092; ICSV 93093; CSH1; ICSV1; ICSV 700 and Local (check). Seeds were sown at a rate of 2 seeds/hill and 15 cm space between hills. Three replicates were selected for each sorghum line. All experimental plots received the usual agricultural practices and no control measures was applied. The sowing dates were July 14 and 15 for 2000 and 2001 seasons,respectively.

Sampling:

Concerning sorghum shootfly, *A. soccata*, 25 plants/replicate were randomly chosen (when the plants aged up to 28 days from sowing date) and examined for dead hearts (the symptoms of this insect). The numbers of infested plants were recorded and the percentage of infestations were calculated.

Concerning the stem borer, *S. cretica*, also 25 plants/replicate were randomly selected (at harvest time) and carefully inspected for borers infestation. Then, the percentage of infestations were calculated. Single and multiple insect resistance were calculated on the basis of rating scale according to Sharma *et al.* 1992 (Table 1).

Table(1) : Rating scale for the percentage of infestations for single and multiple insect resistance.

Range of infestation				Classification
SIR		MIR		
% Damage	Score	% Damage	Score	
<10	1	0	1	
11-20	2	1-10	2	Resistant
21-30	3	11-20	3	
31-40	4	21-30	4	Moderately
41-50	5	31-40	5	Resistant
51-60	6	41-50	6	Moderately
61-70	7	51-60	7	Susceptible
71-80	8	61-70	8	Susceptible
>81	9	>71	9	

SIR = Single insect resistance. MIR = Multiple insect resistance

Results and Discussion

Data of 2000 and 2001 seasons (Table 2) revealed that the percentages of dead hearts caused by *A. soccata* up to 28 days after sowing date were less than 30% in all the tested sorghum lines except PB15925 line, which has 38.22 and 40.00% dead hearts during 2000 and 2001 seasons, respectively, with an average infestation of 39.11%.

According to rating scale, all the tested lines were considered resistant and could be used profitably in breeding programme for evolving shootfly resistant lines. However, the PB15925 line was considered moderately resistant. The obtained results are in full agreement with those of Blum, 1967; Jotwani *et al.*, 1971a,b; Rao, 1972; Soto, 1972; Singh *et al.*, 1978 and Naik and Bhutil, 1985). Singh *et al.*, 1978 found that the sorghum lines, IS-1054, IS-5490, IS-5604 and IS-5633 possess good resistance to shootfly. Naik and Bhutil, 1985 screened 28 sorghum lines for resistance to shootfly and found that the percentages of dead hearts ranged from 17.1 to 34.3%.

Data of Table 3 show the percentage of infestations caused by *S. cretica* during 2000 and 2001 seasons. Lines PB15621-1-1-2-2, PB15833-1-1, ICSV 700 and Local during 2000 and 2001 seasons and IS 2205 during 2000 season had infestation rate less than 10%. The rest lines had percentage of infestations less than 20%. Thus, all the tested lines, according to rating scale were considered resistant for *S. cretica* and they serve as a good material for cultivating in the area where the pest is a problem. Dabrowski and Kidiavai, 1983 reported that resistance in sorghum lines to *Chilo partelluss* may due to non-preference for oviposition, feeding of the first larval instar on young leaves and tolerance of plants. Salman, 2001 reported that sorghum varieties and hybrids varied significantly in their susceptibility to stem borer, *S. cretica* infestation. Sorghum varieties were more susceptible than sorghum hybrids.

Concerning the overall mean percentage of infestations by *A. soccata* and *S. cretica* during 2000 and 2001 seasons (Table 4). The percentages ranged from 23.56 to 49.78 and 25.34 to 52.44% during 2000 and 2001 seasons, respectively. On the basis of multiple resistance, the sorghum lines PB 15925 and ICSV 93093 were found to be moderate susceptible and the remaining lines (23 lines) could be considered as moderate resistance against both pests during both seasons. These 23 lines could be used profitably in breeding programme to produce sorghum lines resistant to these serious pests.

Table (2): Average percentage of dead hearts in sorghum caused by sorghum shootfly, *A. soccata* in Sohag during 2000 and 2001 seasons.

No.	Sorghum Lines	Average % of dead hearts		Average
		Summer 2000	Summer 2001	
1	IS 2205	15.56	16.00	15.78
2	IS 18551	22.22	24.89	23.55
3	PB 14390-4	16.89	18.22	17.55
4	PB 14844-1	16.00	18.67	17.33
5	PB 15157-4-1-2	22.22	20.00	21.11
6	PB 15520-2-2-2	18.22	19.56	18.89
7	PB 15438	16.89	17.33	17.11
8	PB 15621-1-2-2	18.67	19.56	19.11
9	PB 15828-2H	17.33	18.67	18.00
10	PB 15833-1-1	24.00	25.78	24.89
11	PB 15833-3-1H	15.11	13.11	14.22
12	PB 15856	15.56	17.78	16.67
13	PB 15881-3	21.78	22.67	22.22
14	PB 15925	38.22	40.00	39.11
15	ICSV 93087	19.56	21.33	20.44
16	ICSV 93088	17.33	18.67	18.00
17	ICSV 93089	26.22	26.67	26.44
18	ICSV 93090	20.00	21.78	20.89
19	ICSV 93091	15.11	19.11	17.11
20	ICSV 93092	20.44	21.33	20.88
21	ICSV 93093	28.44	29.33	28.88
22	CSH1	24.00	12.00	18.00
23	ICSV1	17.78	19.11	18.44
24	ICSV 700	16.89	17.78	17.33
25	Local (check)	24.44	26.67	25.55
	F	15.93**	14.60**	
	LSD	3.74	4.22	

Table (3): Average percentage of infested sorghum plants caused by the stem borer, *S. cretica* in Sohag during 2000 and 2001 seasons.

No.	Sorghum lines	Average % of infested plants		Average
		Summer 2000	Summer 2001	
1	IS 2205	9.33	10.67	10.00
2	IS 18551	11.11	12.44	11.77
3	PB 14390-4	11.56	12.89	12.22
4	PB 14844-1	12.89	13.77	13.33
5	PB 15157-4-1-2	12.00	12.89	12.42
6	PB 15520-2-2-2	12.00	12.89	12.44
7	PB 15438	12.44	12.44	12.44
8	PB 15621-1-2-2	8.89	9.33	9.11
9	PB 15828-2H	11.56	11.56	11.56
10	PB 15833-1-1	8.00	8.89	8.45
11	PB 15833-3-1H	12.89	13.33	13.11
12	PB 15856	11.11	12.00	11.55
13	PB 15881-3	11.56	12.00	11.78
14	PB 15925	11.56	12.44	12.00
15	ICSV 93087	10.22	10.67	10.44
16	ICSV 93088	14.67	16.00	15.33
17	ICSV 93089	12.89	14.22	13.55
18	ICSV 93090	12.89	13.33	13.11
19	ICSV 93091	12.00	12.89	12.44
20	ICSV 93092	11.11	11.56	11.33
21	ICSV 93093	14.22	14.67	14.44
22	CSH1	12.00	12.44	12.22
23	ICSV1	11.56	12.00	11.78
24	ICSV 700	6.67	7.56	7.11
25	Local (check)	7.50	7.11	7.33
	F	3.60**	6.46**	
	LSD	2.92	2.32	

Table(4) :Correlation between infestation by sorghum shootfly and corn stem borer, and sorghum yield during 2000 and 2001 seasons (Sohag, upper Egypt).

No.	Sorghum lines	Total infestation %		Yield kg/ 1/400 fed.	
		Summer 2000	Summer 2001	Summer 2000	Summer 2001
1	IS 2205	24.89	26.67	4.00	3.46
2	IS 18551	33.33	37.33	3.83	3.67
3	PB 14390-4	28.45	31.11	4.23	4.00
4	PB 14844-1	28.89	32.44	3.28	3.23
5	PB 15157-4-1-2	34.22	32.89	3.73	3.33
6	PB 15520-2-2-2	30.22	32.45	3.50	3.33
7	PB 15438	29.33	29.77	3.60	3.33
8	PB 15621-1-2-2	27.56	28.89	4.10	4.23
9	PB 15828-2H	28.89	30.23	4.32	4.17
10	PB 15833-1-1	32.00	34.67	3.90	3.97
11	PB 15833-3-1H	28.00	26.44	4.60	4.37
12	PB 15856	26.67	29.78	3.96	3.83
13	PB 15881-3	33.34	34.67	3.73	3.80
14	PB 15925	49.78	52.44	3.25	3.23
15	ICSV 93087	29.78	32.00	4.53	4.40
16	ICSV 93088	32.00	34.67	3.40	3.33
17	ICSV 93089	39.11	40.89	3.77	3.67
18	ICSV 93090	32.89	35.11	3.70	3.67
19	ICSV 93091	27.11	32.00	4.03	4.00
20	ICSV 93092	31.55	32.89	4.63	4.50
21	ICSV 93093	42.66	44.00	3.77	3.70
22	CSH1	36.00	24.44	4.97	5.07
23	ICSV1	29.34	31.11	4.30	4.40
24	ICSV 700	23.56	25.34	4.29	4.07
25	Local (check)	31.94	33.78	4.30	4.07
	F	14.55**	10.54**	4.13**	4.51**
	LSD	4.22	4.11	0.616	0.622

r (2000) = -0.338 r (2001) = -0.523**

Similar results were obtained by Singh and Grewal, 1997 who screened 26 advanced sorghum genotype from ICRISAT against shootfly, *A. soccata* and stem borer, *C. partellus* under natural infestation condition of Hisar. They concluded that ICSV 700 and IS 2312 lines were highly promising sources for breeding against both pests.

Data in Table 4 also show negative correlation between the overall mean infestation by the two pests and the yield of sorghum lines. The sorghum line CSHI gave the highest yield (4.97 and 5.07 kg/plot) while PB15925 line gave the least yield (3.25 and 3.23 kg/plot) during 2000 and 2001 seasons, respectively.

Jotwani *et al.* (1971c) revealed that the loss of grain due to stem borer varied from 55.49 to 83.70 percent. Rai *et al.* (1978) reported that 39 to 57 kg reduction in grain yield per hectare with increase in one percent dead hearts due to shootfly in CSH-5 line. Chundurwar and Karanjkar (1979) found that for each percent increase in dead hearts due to shootfly, there was a reduction of grain yield of 143 kg/ha in CSH-8R line.

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تقييم بعض سلالات الذرة الرفيعة للمقاومة الفردية والمتعددة لذبابة القمة النامية ودودة القصب الكبيرة تحت الظروف الحقلية فى محافظة سوهاج ، مصر العليا

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تم اختبار درجة المقاومة الفردية والمتعددة لـ ٢٥ سلالة ذرة رفيعة ضد الاصابة بآفتين من أهم آفات الذرة الرفيعة وهما ذبابة القمة النامية ودودة القصب الكبيرة وذلك تحت الظروف الحقلية السائدة بمحافظة سوهاج – مصر العليا خلال موسمى ٢٠٠٠ و ٢٠٠١ . وقد وجد أن كل السلالات المختبرة كانت مقاومة لذبابة القمة النامية فيما عدا السلالة PB 15925 والتى أظهرت مقاومة متوسطة لهذه الحشرة . أيضا فإن كل السلالات المختبرة كانت مقاومة لدودة القصب الكبيرة حيث أن نسبة الاصابة بهذه الحشرة كانت أقل من ١٠% فى خمس سلالات وهى IS 2205 و PB15621-1-2-2 و PB 15833-1-1 و ICSV 700 والصنف المحلى بينما كانت نسبة الاصابة اقل من ٢٠% فى باقى السلالات. أما فيما يخص المقاومة المتعددة لهاتين الآفتين فقد أعتبرت السلالتين PB15925 و ICSV93093 ذات حساسية متوسطة بينما أظهرت الثلاث والعشرون سلالة الباقية درجة مقاومة متوسطة ولهذا فإنه يمكن إدخال هذه السلالات الأخيرة فى برامج التربية ضد هاتين الآفتين . وقد إختلف محصول السلالات المختبرة إختلافا معنويا مع نسبة الإصابة بهاتين الآفتين وكانت درجة الارتباط سالبة بينهما . حيث أعطت السلالة CSH1 أعلى محصول بينما أعطت السلالة PB15925 أقل محصول .