



Screening of Jowar Germplasm Against Stemborer (*Chilo partellus* Swinhoe.) and Aphid (*Rhopalosiphum maidis* Fitch.)

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ABSTRACT

Eighty sorghum germplasm lines were screened during early *rabi* season, 2004, 2005 and 2006 to evaluate their reaction against stem borer and aphids at Agricultural Research Station, Madhira, Khammam district. Mean per cent deadheart and aphid incidence were computed. Based on their performance over three years, the germplasm viz., EP 19 (10.57%), EP 36 (3.47 %) and EP 28 (10.38 %) were shown tolerance and recorded higher yields 2994, 2605 and 2450 Kg ha⁻¹ respectively, whereas SEVS 1, SEVS 6, EP 44, SEVS 2, EP 111 and EP 118 were susceptible to both the pests.

Key words : Aphid, Germplasm, Sorghum, Stemborer.

Sorghum (*Sorghum bicolor* L.) is the third most important cereal after rice and wheat. Green revolution attempts in other crops including sorghum have failed due to a number of major insect pests. It is also a major fodder crop of India mainly grown in the semi-arid and sub-humid zones of the country. Stemborer (*Chilo partellus* S.) and aphid (*Rhopalosiphum maidis* F.) are serious pests of jowar in India. Stem borer being internal feeder pose serious problem in achieving the targeted yield (Prem Kishore, 2000, 2001a and 2001b). Both adults and nymphs of sorghum aphid suck sap from leaves and earheads. Infested leaves exhibit mottled appearance with yellow patches, sooty mould appearance on infested parts due to excretion of honey dew. Severely infested earheads can't exert out from the flag leaf. Grains do not develop in the affected earheads. The availability of resistant sources has been greatly emphasized all over the world as one of the most appropriate tool of IPM. The present studies were therefore, undertaken to investigate the relative performance of germplasm to the pest attack, which will further be helpful in evolution of resistant varieties and hybrids through regular breeding programme.

MATERIAL AND METHODS

A field experiment on screening of 80 sorghum germplasm lines obtained from National Research Centre on Sorghum (NRCS), Hyderabad was undertaken at Agricultural Research Station, Madhira, Khammam district during early *rabi* season of 2004, 2005 and 2006. Experiments were laid out in augmented design. Each entry was sown in two rows of 6 m length with inter- and intra-row spacing

of 45X15 cm. Recommended package of practices were followed except plant protection measures. Observations were made from 21 days after emergence of seedlings on per cent deadhearts due to stemborer and aphid infestation was recorded from 60 days old crop to harvesting at weekly intervals and mean of three years were calculated. Three years yield data and per cent deadheart damage due to stemborer among 80 germplasm lines were analysed statistically. Based on their performance over three years, the germplasm were categorized as per 1-9 scale:

Scale	Pest incidence	Reaction
1	No damage	Resistant
3	< 10% Pod damage	Moderately Resistant
5	11 - 20% Pod damage	Tolerant
7	21 - 40% Pod damage	Moderately Susceptible
9	> 40 % Pod damage	Highly Susceptible

RESULTS AND DISCUSSION

The incidence of stemborer was noticed from vegetative stage to harvesting stage and its damage in terms of formation of deadhearts ranged from 3.47 to 22.18%. The pooled results over three years revealed that all the germplasm showed stem borer incidence and there were significant differences among germplasm lines. Minimum damage recorded in the entries viz., EP 36 (3.47%), EP 27 (5.25%) and EP 32 (5.9%) and the entries, EP 31 (22.18%), EP 119 (21.98%) and EP 43 (21.91%) were found to be susceptible to stemborer damage

Table 1. Stemborer deadheart percentage and yield of sorghum germplasm in early *rabi* seasons.

S.No	Germplasm	% deadheart			Mean	Score (1-9-Scale)	Reaction	Yield (Kg ha ⁻¹)
		2004	2005	2006				
1	EP 1	16.67	17.67	18.28	17.54	5	S	2049
2	EP 2	9.30	10.40	9.80	9.83	3	MR	1481
3	EP 3	12.82	18.22	16.28	15.77	5	S	2876
4	EP 4	13.79	19.73	17.93	17.15	5	S	2315
5	EP 5	11.76	17.61	21.86	17.08	5	S	1935
6	EP 6	10.36	13.40	18.50	14.08	5	S	1870
7	EP 7	21.95	19.94	21.80	21.23	7	MS	1614
8	EP 8	12.50	13.90	15.90	14.10	5	S	2617
9	EP 9	11.76	19.86	20.97	17.53	5	S	2037
10	EP 10	17.24	12.74	14.27	14.75	5	S	2432
11	EP 11	20.69	21.50	22.00	21.40	7	MS	2342
12	EP 12	8.82	10.80	9.90	9.84	3	MR	1456
13	EP 13	8.82	10.26	10.50	9.86	3	MR	2080
14	EP 14	5.88	9.80	10.00	8.56	3	MR	1796
15	EP 15	12.82	18.28	15.34	5.48	5	S	1784
16	EP 16	20.59	20.95	21.87	21.14	7	MS	2750
17	EP 17	14.98	15.38	20.45	16.94	5	S	2944
18	EP 18	11.76	18.67	12.86	14.43	5	S	2015
19	EP 19	10.34	10.58	10.80	10.57	3	MR	2994
20	EP 20	10.85	10.43	10.50	10.59	3	MR	1802
21	EP 21	13.16	16.30	18.36	15.94	5	S	1565
22	EP 22	15.15	16.90	18.70	16.92	3	MS	2543
23	EP 23	15.79	19.75	17.95	17.88	5	MS	2401
24	EP 24	28.57	10.50	8.25	15.77	5	S	2200
25	EP 25	13.51	15.30	16.98	15.26	5	S	1626
26	EP 26	17.88	18.78	19.90	18.85	5	S	1667
27	EP 27	2.70	7.20	5.80	5.23	3	MR	1617
28	EP 28	9.68	10.86	10.60	10.38	3	MR	2450
29	EP 29	15.79	19.75	17.59	17.71	5	S	2117
30	EP 30	18.18	118.18	22.50	19.83	5	S	1488
31	EP 31	26.32	20.12	20.10	22.18	7	MS	1716
32	EP 32	5.56	6.510	5.65	5.90	3	MR	2043
33	EP 33	10.71	11.70	11.00	11.14	5	S	2531
34	EP 34	16.13	13.61	11.63	13.79	5	S	1543
35	EP 35	7.89	8.97	7.98	8.28	3	MR	2969
36	EP 36	2.78	3.82	3.80	3.47	3	MR	2605
37	EP 37	13.79	17.90	19.70	17.13	5	S	1617
38	EP 38	15.79	19.15	17.50	17.48	5	S	2568
39	EP 39	17.99	20.70	22.00	20.23	5	S	2247
40	EP 40	21.74	20.40	22.00	21.38	7	MS	2395
41	EP 41	19.78	17.10	18.90	18.59	5	S	1747
42	EP 42	10.71	17.90	18.10	15.57	5	S	2188
43	EP 43	25.93	20.30	19.50	21.91	7	MS	2376
44	EP 44	20.15	21.50	21.90	21.18	7	MS	2025
45	EP 45	10.53	15.30	13.50	13.11	5	S	2222
46	EP 46	8.19	10.80	11.10	10.03	3	MR	2006
47	EP 47	5.56	5.90	10.00	7.15	3	MR	1975
48	EP 48	15.89	19.80	18.90	18.20	5	S	2222
49	EP 49	16.50	17.60	16.90	17.67	5	S	1139
50	EP 50	13.16	16.30	16.80	16.09	5	S	2197

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Table 1. Stem-borer deadheart percentage and yield of sorghum germplasm in early *rabi* seasons.

S.No	Germplasm	% deadheart			Mean	Score (1-9-Scale)	Reaction	Yield (Kg ha ⁻¹)
		2004	2005	2006				
51	EP51	19.73	21.90	23.11	21.58	7	MS	1234
52	EP52	19.73	21.70	23.30	21.58	7	MS	1200
53	EP97	5.40	10.00	8.50	7.97	3	MR	876
54	EP98	7.90	9.60	7.90	8.49	3	MR	1367
55	EP99	9.09	10.50	10.30	9.96	3	MR	2003
56	EP100	21.05	22.00	20.50	21.18	7	MS	2231
57	EP101	17.95	19.50	20.50	19.32	5	S	2858
58	EP102	10.53	11.00	10.90	10.81	3	MR	1373
59	EP103	10.71	11.00	10.50	10.74	3	MR	1790
60	EP104	8.11	8.90	8.80	8.60	3	MR	2191
61	EP105	15.38	18.50	18.30	17.39	5	S	2120
62	EP106	18.42	19.70	20.50	19.54	5	S	1910
63	EP107	14.29	19.40	18.90	17.53	5	S	1426
64	EP108	21.50	21.00	20.80	21.10	7	MS	1327
65	EP109	19.73	21.80	21.90	21.14	7	MS	1935
66	EP110	17.24	20.00	20.80	19.68	5	S	1667
67	EP111	11.11	11.00	11.90	11.34	5	S	1762
68	EP112	7.41	8.90	10.00	8.77	3	MR	1043
69	EP113	10.71	15.80	17.10	14.54	5	S	2225
70	EP114	20.70	20.90	22.00	21.20	7	MS	901
71	EP115	10.71	15.00	17.10	14.27	5	S	1241
72	EP116	13.79	19.70	20.80	18.10	5	S	1682
73	EP117	20.30	22.00	22.50	21.60	7	MS	1500
74	EP118	21.43	22.00	22.50	21.98	7	MS	2194
75	EP119	5.26	6.50	7.20	6.32	3	MR	1821
76	SEVS 1	19.52	21.90	22.00	21.14	7	MS	3324
77	SEVS 2	21.50	22.00	21.80	21.77	7	MS	1864
78	SEVS 4	11.11	14.80	15.30	13.74	5	S	1540
79	SEVS 5	7.69	9.80	10.00	9.16	3	MR	2034
80	SEVS 6	21.90	19.90	21.50	21.10	7	MS	2080
	SEm ±				1.27			518
	CD (5%)				3.53			NS
	CV(%)				14.3			45.3
	F test				S			

MS- Moderately Susceptible S- Susceptible MR - Moderately Resistant S- Significant
 NS- Non-significant

Table 2. Categorization of sorghum germplasm lines based on field reaction to stem borer.

Scale(1-9)	No. of Germplasm (Per cent damage)	Name of the germplasm line
3: (Moderately Resistant <10% damage)	22 (3.47-10.81%)	EP 36, EP 27, EP 32, EP 120, EP 47, EP 97, EP 35, EP 98, EP 14, EP 104, EP 112, SEVS 5, EP 2, EP 12, EP 13, EP 99, EP 46, EP 28, EP 19, EP 20, EP 103, EP 102.
5: (11-20% Damage)	44 (11.14-20.89%)	EP 33, EP 111, EP 45, SEVS 4, EP34, EP 6, EP 8, EP115, EP 18, EP113, EP 10, EP 25, EP 15, EP 42, EP 3, EP 24, EP 21, EP 50, EP 22, EP 17, EP 5, EP 37, EP 4, EP 105, EP 38, EP 107, EP 9, EP 1, EP 49, EP 29, EP 23, EP 116, EP48, EP 41, EP 26, EP 101, EP 106, EP 110, EP 30, EP 39, EP 51, EP 52, EP 108 EP 109.
7: (Moderately Susceptible 21-40% damage)	14 (21.10-22.18%)	SEVS 6, EP 16, EP 100, EP 44, EP114, EP 7, EP 40, EP 11, SEVS 1, EP 118, SEVS 2, EP 43, EP 119, EP 31.

Table 3. Categorization of sorghum germplasm lines based on their reaction to aphid.

Scale(1-9)	No. of Germplasm (Per cent damage)	Name of the germplasm line
1: No damage/ Resistant (Nil Population)	30	EP 1, EP 2, EP 3, EP 4, EP 5, EP 6, EP 7, EP 8, EP 9, EP 11, EP 13, EP 18, EP 21, EP 23, EP 24, EP 33, EP 35, EP 38, EP 40, EP 45, EP 47, EP 48, EP 49, EP 97, EP 102, EP 104, EP109, EP111, EP 115, EP 116.
3: Moderately Resistant(leaves infested with 1 or 2 small colonies)	40	EP 10, EP 12, EP 14, EP 15, EP 16, EP 17, EP 19, EP 20, EP22, EP 25, EP 26, EP27, EP 28, EP 30, EP31, EP 32, EP34, EP 36, EP 37, EP 39, EP41, EP 42, EP 43, EP 46, EP50, EP 51, EP 52, EP 98, EP 99, EP100, EP 101, EP 103, EP 105, EP 106, EP 107, EP 108, EP 110, EP 112, EP 113, EP114.
9: Highly susceptible (Leaves and earheads infested fully)	10	EP 29, EP 44, EP 118, EP119, EP 120, SEVS 1, SEVS 2, SEVS 4, SEVS 5, SEVS 6

Table 4. Sorghum germplasm lines resistant to both stem borer and aphids

S.No	Germplasm	Yield (Kg ha ⁻¹)
1.	EP 19	2994
2.	EP 36	2605
3.	EP 28	2450
4.	EP 32	2043
5.	EP 46	2006
6.	EP 99	2003
7.	EP 20	1802
8.	EP 14	1796
9.	EP 103	1790
10.	EP 27	1617
11.	EP 12	1456
12.	EP 98	1367

Table 5. Sorghum germplasm lines susceptible to both stem borer and aphid

S.No	Germplasm	Yield (Kg ha ⁻¹)
1.	SEVS 1	3324
2.	SEVS 6	2080
3.	EP 44	2025
4.	SEVS 2	1864
5.	EP 111	1762
6.	EP 118	1500

(Table 1). Prem Kishore *et al.*, (2002) reported that, the mean percentage deadhearts due to stem borer ranged from 15.4 to 52.0%. The presence of resistance in sorghum to stem borer was first shown by Trehan and Butani, 1949. Other reports about sorghum varieties to be less damaged by stem borer were given by Pant *et al.*, (1961) and Swarup and Chaugale (1962). Various workers in India and elsewhere reported large number of germplasm lines and derivatives as resistant to stem borer (Jotwani, 1978; Prem Kishore, 1987). The lesser damage in the germplasm might be due to less preference by stem borer for egg laying (Rana and Murthy, 1971; Lal and Pant, 1980; Singh and Rana, 1984).

Aphid incidence was noticed from October last week onwards upto December end with a peak in November month which coincides with booting to panicle emergence of crop stage. Based on the severity of infestation from bottom leaves to earheads

over three years, germplasm categorized based on 1-9 scale revealed that, 30 were resistant and 10 were highly susceptible lines to aphid among 80 screened germplasm lines (Table 3).

Overall performance

The yield data pooled over three years ranged from 901– 3324 kg ha⁻¹ and showed non-significance results among the years. Results revealed that 12 germplasm found to be promising, among which EP 19 (2994), EP 36 (2605) and EP 28 (2450) recorded higher yields, whereas 6 germplasm lines were found highly susceptible to both the pests (Table 4 and 5). Though the germplasm SEVS 1 is susceptible, it recorded highest yield (3324 kg ha⁻¹) than all other lines. Similar trend was reported by Prem Kishore and Jotwani, 1979 that they observed resistance in E-623, a derivative of (IS 3687 X Aisपुरi) X (IS 3922 X Karad local) which developed healthy tillers after the main shoot was killed by the stem borer. The tillers matured almost simultaneously and grain yield was significantly higher in undamaged plants.

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