Research Paper :

Evaluation of sorghum genotypes in aphid and shoot bug nursery against major pests

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SUMMARY

The study was carried out during *Rabi* 2006-07 at the Regional Agricultural Research Station, Bijapur, Karnataka, India. Totally 49 entries from Aphid and Shoot bug Nursery were selected for the experiment including resistant (Y 75 for shoot bug and T x 428 for aphid), susceptible checks (Hathi Kuntha for shoot bug and 296B for aphid) and local checks (DSV 4 and DSV 5). The entries *viz.*, CSV 216R, EC 8-2, PEC-10-1, SLR 37, SLR 1, SLR 47, IS 33722, SLV 35, SLR 32, Maulee, PU 10-1 and IS 33844-1 were found to be resistant to shoot fly based on dead hearts and trichomes on the lower surface of leaf. Among different genotypes *viz.*, T x 428, EP 65 and SLR 37 were grouped under resistant category for aphids. The entries *viz.*, T x 428, CSV 216R, SLV 29, SLV 31, SLR 35, SLR 37, SLR 10 and Y 75 were found to be resistant to shoot bug by recording significantly lowest shoot bug population density per plant and percentage of plant damage due to sorghum stripe disease caused by shoot bug. Thus, the genotype SLR 37 exhibited multiple resistance to shoot fly, shoot bug and aphid. The genotype T x 428 was found to posses multiple resistances to aphid and shoot bug.

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Shoot fly (*Atherigona soccata* Rondani), aphid (*Melanaphis sacchari* Zehntner) and shoot bug (*Peregrinus maidis* Ashmead) are serious pests of *Rabi* sorghum in Northern Karnataka, India. Most of the released hybrids and high yielding varieties are highly susceptible to these pests. Shoot fly is one of the serious pests of sorghum, which causes damage to the seedlings and young plants resulting in deadhearts. Sorghum aphid is becoming economically important in recent years in many sorghum-growing areas leading to losses in grain and fodder yield. The shoot bug is a major hurdle in *Rabi* sorghum production by causing dual problem of direct loss by sucking the sap and indirect damage by transmitting sorghum stripe disease. Hence, it comes in the way of harvesting potential yield of grain and fodder. Effective chemical control measures have been developed for their control which involves the number of insecticidal treatments. The limitations of these methods are pollution hazards and cash inputs for plant protection. Moreover, insecticides are hazardous to many target and non-target species in addition to disturbance in crop eco-system which led scientists to find out newer, safer, cost effective alternatives as the components of integrated pest management (Pawar and Kadam, 1995; Balikai, 2003). Further, the relationship of various plant characters with shoot fly resistance has been studied earlier by many workers (Singh and Rana, 1986; Patel and Sukhani, 1990). The resistant cultivars reduce the cost, are easy to execute and can fit in the IPM programme. In this study, an attempt has been made to know the reaction of various sorghum genotypes in aphid and shoot bug nursery to major pests.

MATERIALS AND METHODS

The study was carried out during *Rabi* 2006-07 at the Regional Agricultural Research Station, Bijapur, Karnataka, India. In total 49 entries from Aphid and Shoot bug Nursery were selected for the experiment including resistant (Y 75 for shoot bug and T x 428 for aphid), susceptible checks (Hathi Kuntha for shoot bug and 296B for aphid) and local checks (DSV 4 and DSV 5). These entries were obtained from the National Research Centre for Sorghum, Hyderabad under All India Co-ordinated Sorghum Improvement Project. The experiments were conducted in a randomized block design with three replications in a plot size of 1.2 x 4.0 m (2 lines of 4 m length) during *Rabi* season using fish meal technique. The dead hearts caused by shoot fly were recorded at 28 days after emergence of the crop (DAE). For recording leaf trichome density, the central portion of the fifth leaf from the base was taken from three randomly selected seedlings in each entry at 12-14 days after seedling emergence from each replication. Leaf bits (approximately 0.5 cm^2) were placed in 20 ml of acetic acid:alcohol (2:1) in small vials (1.5 cm diameter, 5.75 cm height) for overnight. The cleared samples were transferred to 90 per cent lactic acid in small vials and stored for later observations. For microscopic examination, the leaf samples were mounted on a slide in a drop of water and observed under stereomicroscope at a magnification of 10 X. The number of trichomes on the lower leaf surfaces was counted in three microscopic fields selected at random and expressed as trichome density per square millimeter (No./mm^2).

The aphid population density was recorded on all the five randomly selected plants in each treatment at peak incidence during third week of January (80 DAE). Six leaves in each plant from apex to downward excluding flag leaf as well as dried leaves at the bottom were observed for aphid colonies and rated using 0-9 scale as explained by Kadam and Mote, 1983. The shoot bug population density (both nymphs and adults) was recorded on five randomly selected plants in each genotype at 45 DAE. The average population per plant was worked out. Total number of plants in each entry was recorded and number of plants showing yellowing, girdling and stunted growth were recorded at 70 DAE and percentage of plant damage due to sorghum stripe disease was worked out.

RESULTS AND DISCUSSION

At 28 DAE, the genotypes, CSV 216R (18.0), EC 8-2 (18.3), PEC-10-1 (20.1), SLR 37 (20.2), SLR 1(20.5), SLR 47 (20.8), IS 33722 (22.4), SLV 35 (23.5), SLR 32 (22.0), Maulee (24.5), PU 10-1 (24.9) and IS 33844-1 (24.6) recorded lowest per cent of dead hearts and were at par with resistant check IS 2312 (25.0 %) (Table 1). Thus, these genotypes could be considered as promising resistant sources for further varietal improvement programme in *Rabi* sorghum. The results of the present investigation are in close agreement with the studies of Singh *et al.* (1989) who reported that resistant sorghum germplasm *viz.*, IS 5359 and IS 5470 had the lowest dead hearts formation. Balikai and Kullaiswamy (1999) reported that, M 35-1 x SPV 488, M 35-1 x 19B, M 35-1 x Afzalpur local, M 35-1 x Selection 3 and M 35-1 x IS 2315 were promising on the basis of percentage of dead hearts. Kumar *et al.* (2003) reported that, the genotypes ICSV 708 and ICSV 705 recorded the lowest number of deadhearts, while CSV 1 and DJ 6514 recorded the highest dead heart formation. Balikai and Biradar (2004) reported that, the entries *viz.*, IS 2191, IS 4481, IS 4516, IS 17596, IS 18366, IS 33714, IS 33717, IS 33722, IS 33740, IS 33742, IS 33756, IS 33761, IS 33764, IS 33810, IS 33820, IS 33839, IS 33843 and IS 33889 were identified as resistant to shoot fly by recording lowest percentage of dead hearts and were statistically at par with the resistant check, IS-2312.

Number of trichomes present on the lower surface of the leaves at 12-14 days after emergence of the crop revealed that, significantly highest number of trichomes were observed in SLR 34 (37.2/mm^2), EP 56 (37.2/mm^2) followed by SLR 39 (35.3/mm^2). The local check DSV 4 was free from trichomes on the lower surface of the leaves. The remaining entries recorded trichome density ranging from 0.5 to 31.0/mm^2 (Table 1). Thus, the cultivars having more number of trichomes could be considered as sources of resistance for using in the varietal improvement programmes in *Rabi* sorghum. The results of the present studies also corroborate with the reports of Singh and Rana (1996) who reported that, trichomes are frequently associated with shoot fly resistance.

Aphid population density was recorded on 1 to 9 grade at 80 days after emergence. Among different genotypes *viz.,* T x 428 (1.0), EP 65 (2.0) and SLR 37 (2.0) were grouped under resistant category. Fifteen genotypes whose score varied from 2.1 to 3.0 were grouped under moderately resistant and twenty six entries with score of 3.1 to 5.0 were grouped under moderately susceptible and SLR 32 (5.3) was grouped under susceptible category. Susceptible check 296B recorded highest grade of 8.3 (Table 1). The results of the present study are in conformity with Balikai (2001) who reported that, SPV 570, RS 29 and C 49 were highly resistant to aphid, *M. sacchari* by recording score of less than 2. Ghuguskar *et al.* (1999) reported that, hybrids CSH 16 and 9728 were resistant to aphids by recording lowest score. Teetes *et al.* (1995) reported that, lines IS 12664C,

Table 1: Response of sorghum genotypes in aphid and shoot bug nursery to shoot fly, aphid and shoot bug incidence

Sr. No.	Entry	Shoot fly deadhearts (%) 28 DAE	Trichome density (No./mm^2)	Sorghum aphid population density (1-9) 80 DAE	Shoot bug population/ plant (No.) 45 DAE	Shoot bug plant damage (%) 70 DAE
1.	SLR 1	20.5(26.9)*	14.0	3.0	16.1	8.2 (16.6)
2.	SLR 5	26.2 (30.8)	24.4	3.3	23.0	10.0 (18.4)
3.	SLR 8	26.3 (30.8)	22.5	3.3	12.5	9.1 (17.5)
4.	SLR 10	28.3 (32.1)	20.1	2.7	6.1	2.4 (8.7)
5.	SLR 13	38.9 (38.6)	20.5	3.7	16.4	13.4 (21.5)
6.	SLR 17	27.4 (31.5)	14.3	4.3	23.3	12.5 (20.6)
7.	SLR 24	30.0 (33.2)	20.5	3.3	18.4	7.7 (15.7)
8.	SLR 25	31.7 (34.2)	22.3	3.0	26.9	9.1 (17.2)
9.	SLR 27	33.9 (35.5)	29.9	4.7	19.2	10.1 (18.3)
10.	SLR 28	30.7 (33.6)	21.7	4.3	18.4	12.4 (20.5)
11.	SLR 29	25.7 (30.4)	12.2	2.7	10.4	10.6 (19.0)
12.	SLR 31	36.2 (36.9)	15.7	4.0	27.0	15.4 (23.1)
13.	SLR 32	22.0 (27.9)	28.3	5.3	26.1	10.0 (18.4)
14.	SLR 34	33.8 (35.5)	37.2	3.0	12.4	5.6 (13.3)
15.	SLR 35	34.3 (35.8)	26.0	4.0	6.5	1.3 (6.4)
16.	SLR 37	20.2 (26.6)	16.7	2.0	5.9	1.3 (6.4)
17.	SLR 38	26.0 (30.7)	30.7	3.0	16.5	9.3 (17.2)
18.	SLR 39	34.6 (36.0)	35.3	4.3	24.0	8.1 (16.5)
19.	SLR 40	29.1 (32.6)	14.7	3.6	26.7	9.0 (17.4)
20.	SLR 41	35.7 (36.7)	17.1	4.7	13.0	20.7 (26.9)
21.	SLR 43	41.1 (39.6)	21.5	4.0	27.0	13.9 (21.5)
22.	SLR 45	25.0 (30.0)	21.5	3.0	13.5	8.6 (16.1)
23.	SLR 46	49.7 (44.8)	30.6	3.7	14.1	6.7 (15.0)
24.	SLR 47	20.8 (27.1)	13.8	3.3	14.8	7.8 (16.0)
25.	SLV 25	28.8 (32.4)	13.9	2.7	9.9	2.4 (8.8)
26.	SLV 27	28.9 (32.5)	13.5	3.3	12.8	10.6 (18.8)
27.	SLV 29	40.3 (39.4)	15.0	3.7	6.7	1.5 (6.9)
28.	SLV 31	35.6 (36.6)	21.6	2.7	4.1	2.3 (8.6)
29.	SLV 35	23.5 (29.0)	28.5	2.3	8.1	16.9 (23.9)
30.	CRS 10	25.8 (30.5)	24.0	3.0	12.6	16.4 (23.9)
31.	CRS 11	30.1 (33.2)	23.8	4.0	15.8	17.4 (24.6)
32.	CRS 2	32.5 (34.7)	21.3	4.7	22.5	5.6 (13.0)
33.	EP 56	42.8 (40.8)	37.2	3.3	19.9	10.8 (19.0)
34.	IS 33722	22.4 (28.3)	26.6	2.7	14.7	17.8 (25.0)
35.	IS 3420	34.4 (35.9)	19.9	4.0	15.1	11.2 (19.4)
36.	EC 8-2	18.3 (25.2)	9.9	4.7	17.9	8.9 (16.7)
37.	IS 33844-1	24.6 (29.7)	19.3	3.0	14.7	8.3 (16.2)
38.	EP 65	42.3 (40.6)	30.5	2.0	12.2	10.7 (19.0)
39.	PEC 10-1	20.1 (26.5)	31.0	3.0	10.6	4.8 (12.5)
40.	PU 10-1	24.9 (29.9)	22.7	2.7	12.9	11.2 (18.8)

Contd... Table 1

Table 1 contd...

41.	M 35-1	27.0 (31.3)	26.1	3.3	25.9	13.0 (21.1)
42.	Maulee	24.5 (29.6)	9.2	3.3	23.7	12.6 (20.7)
43.	CSV 216R	18.0 (25.0)	15.6	4.0	3.4	3.4 (10.5)
44.	T x 428 (RA)	88.9 (71.2)	0.8	1.0	2.3	0.9 (5.2)
45.	296B (SA)	84.3 (66.9)	0.5	8.3	12.2	10.7 (10.7)
46.	Y 75 (RS)	88.3 (70.6)	0.7	3.0	0.9	1.1 (6.0)
47.	Hathi Kuntha (SS)	93.5 (75.7)	27.2	3.3	31.4	22.5 (28.3)
48.	DSV 5 (LC)	37.3 (37.6)	19.0	4.0	21.7	22.2 (28.1)
49.	DSV 4 (LC)	44.1 (41.6)	0.0	4.0	30.6	22.5 (28.3)
	S.E.±	1.7	2.7	-	1.9	2.1
	C.D. (P=0.05)	4.8	7.8	-	5.3	5.7
	CV (%)	8.2	17.9	-	20.7	20.5

DAE= Days after emergence, RA= Resistant check to aphid,
SA= Susceptible check to Aphid, RS= Resistant check to shoot bug,
SS= Susceptible check to shoot bug, LC= Local check,
* Figures in the parentheses are arcsin transformations

IS 12609C, IS 12158C, and IS 12661C were highly resistant in preliminary and advanced screening trials by recording lowest score.

Significantly lowest shoot bug population density per plant was recorded in T x 428 (2.3), CSV 216R (3.4), SLV 31 (4.1), SLR 37 (5.9), and SLR 10 (6.1) as compared to remaining entries (6.5 to 30.6) and were on par with resistant check Y 75 (0.9) (Table 1). Thus, the above genotypes could be considered as promising resistant sources in varietal improvement programmes in *Rabi* sorghum. Similarly, Anaji (2005) reported that, CK 60B, Swati and RS 29 were promising against shoot bug by recording lower shoot bug population. Further, Subbarayudu (2002) reported that, the maximum number of shoot bugs per plant was recorded on genotype M 35-1 (25.8) and the fewest on genotype DJ 6514 (3.5).

Significantly lowest percentage of plant damage due to sorghum stripe disease caused by shoot bug was recorded in T x 428 (0.9), SLR 35 (1.3) and SLR 37 (1.3), SLV 29 (1.5), SLV 31 (2.3), SLV 10 (2.4), SLV 25 (2.4) and CSV 216R (3.4) as compared to remaining entries (4.8 to 22.5) and were at par with resistant check Y 75 (1.1) (Table 1). The results of present study are in close agreement with the results of Subbarayudu (2002) who reported that, the genotype CSV 15 had the maximum number of damaged plants (50.5%) while CSH 6 had the least (9.5%) although differences were not significant.

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REFERENCES

Anaji, R. (2005). Studies on crop loss estimation and management of shoot bug, *Peregrinus maidis* (Ashmead) in *Rabi* sorghum. M. Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad, Karnataka (India).

Balikai, R.A. (2001). Bio-ecology and management of aphid, *Melanaphis sacchari* (Zehntner) on *Rabi* sorghum. Ph.D. Thesis, University of Agricultural Sciences, Dharwad, Karnataka (India).

Balikai, R.A. (2003). Evaluation of IPM modules against major pests of sorghum. Paper Presented in the National Symposium on Biodiversity Management for 21st Century, held at Banaras Hindu University, Varanasi (UP), June 28-30, 2003, p. 103.

Balikai, R.A. and Biradar, B.D. (2004). Performance of sorghum germplasm lines against shoot fly in *Rabi* sorghum. *Agric. Sci. Digest*, **24** (1): 63-64.

Balikai, R.A. and Kullaiswamy, B.Y. (1999). Evaluation of F_2 populations and their parents for resistance to sorghum shoot fly, *Atherigona soccata* Rondani. *Insect Environ.*, **5**(2): 54-55.

Ghuguskar, H.T., Chaudhari, R.V. and Sorte, N.V. (1999). Evaluation of sorghum hybrids for tolerance to aphids, *Melanaphis sacchari* (Zehntner) in field conditions. *PKV Res. J.*, **23**(1): 55-56.

Kadam, J.R. and Mote, U.N. (1983). Evaluation of some sorghums for corn leaf aphid resistance. *Sorghum Newslet.,* **26**: 76.

Kamatar, M.Y. and Salimath, P.M. (2003). Morphological traits of sorghum associated with resistance to shoot fly, *Atherigona soccata* Rondani. *Indian J. Pl. Protec.,* **31**(1) : 73-77.

Kumar, V.K., Reddy, K.D., Rao, M.S. and Singh, B.U. (2003). Evaluation of some sorghum genotypes for shoot fly (*Atherigona soccata* Rond.) resistance. *J. Res. ANGRAU,* **28** (1-2) : 1-6.

Maiti, R.K. (1994). The role of morpho-physiological traits in shoot fly resistance in sorghum. *Internat. Sorghum & Millets Newslet.,* **35**: 107-108

Mote, U.N., Kadam, J.R. and Bapat, D.R. (1986). Antibiosis mechanism of resistance to sorghum shoot fly. *J. Maharashtra Agric. Univ.,* **11**(1) : 43-46.

Patel, G.M. and Sukhani, T.R. (1990). Biophysical plant characters associated with shoot fly resistance. *Indian J. Ent.,* **52** (1) : 14-17.

Pawar, V.M. and Kadam, J.R. (1995). Entomological aspects of integrated pest management in important crops. Maharashtra State level conference on integrated pest management, 26th May, 1995.

Singh, B.U. and Rana, B.S. (1996). Resistance in sorghum to the shoot fly, *Atherigona soccata* Rondani. *Insect Sci. & its Applic.*, **7** (5): 577-587.

Singh, S. and Narayana, K.L. (1978). Influence of different varieties of sorghum on the biology of sorghum shoot fly. *Indian J. Agric. Sci.,* **48(1)**: 8-12.

Singh, Y.P., Singh, A.K., Singh, B. and Pandey, N.D. (1989). Susceptibility of sorghum germplasm to *Atherigona soccata* Rondani. *Farm Sci. J.,* **4** (1, 2) : 28-31.

Subbarayudu, B. (2002). Shoot bug incidence on sorghum in southern India. *Internat. Sorghum & Millets Newslet.,* **43**: 56-57.

Teetes, G.L., Manthe, C.S., Peterson, G.C., Leuschner, K. and Pendleton, B.B. (1995). Sorghum resistant to the sugarcane aphid, *Melanaphis sacchari* (Homoptera: Aphididae) in Botswana and Zimbabwe. *Insect Sci. & its Applic.,* **6**(1) : 63-71.

Verma, Tarun, Singh, S.P. and Verma, T. (2000). Morpho-physio plant characters associated with shoot fly resistance in sorghum. *Haryana Agric. Univ. J. Res.,* **30**(1-2) : 41-43.

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