

RESEARCH ARTICLE

Some physical plant characters in relation to shoot fly, *Atherigona soccata* (Rondani) resistance in sorghum

■ D.R. PATEL^{1*} AND M.S. PUROHIT²

¹Polytechnic in Agriculture, (N.A.U.), Maktampur, BHARUCH (GUJARAT) INDIA

²Department of Entomology, N.M. College of Agriculture, Navasari Agricultural University, NAVASARI (GUJARAT) INDIA

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*Corresponding author:

Email: patel.devendra2829@yahoo.com

ABSTRACT

Field screening of 12 genotypes of sorghum against major insect pest during *Rabi* 2006-07 and 2007-08 showed that among 12 genotypes Nizergoti was found less susceptible to shoot fly. Among different plant characters, the length of leaves exhibited significant positive ($r=0.272$) and number of leaves was found to be significant and negative ($r=-0.255$) influence on incidence of shoot fly ($r=-0.255$).

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INTRODUCTION

Sorghum shoot fly, *Atherigona soccata* (Rondani) acts as limiting factor in the successful cultivation of sorghum crop in India. Screening of 2150 sorghum germplasm against this pest revealed remarkable variations in the level of infestation (Khurana, 1980). Therefore, an attempt was made to establish a possible correlation between physical plant characters and resistance to this pest.

MATERIAL AND METHODS

These studies were carried out at Agricultural Research Station, Navsari Agricultural University, Tanchha, Distt. Bharuch (Gujarat). The experiment was laid out in a randomized block design and replicated thrice at Agricultural Research Station, N.A.U., Tanchha during *Rabi* 2006-07 and 2007-08 under rain fed condition. Twelve genotypes of sorghum viz., SR 655-1, SR 713-1, SR 833-22, SR 1030, SR 1115-1, SR 1638, SR 1657, SR 1665, BP 53, Nizergoti, GJ 36 and GJ 38 were sown in October (*Rabi*) in a plot of 4 rows of 4.0 meter length with 60 cm x 10 cm spacing in *Rabi*. The treatments were replicated thrice. All the post-sowing recommended agronomical

practices were followed. Experimental area was kept free from insecticidal spray throughout the season in order to record the incidence of insect pests.

Observations on the number of dead heart formation due to damage of shoot fly larvae and total number of plants in net plot from each plot were recorded at the interval of 7, 14, 21 and 28 day after sowing. Dead hearts were removed from the plot after each observation in order to avoid confusion during subsequent weekly observation of dead heart. Per cent dead heart formation was calculated from the data. The data were analyzed statistically using appropriate transformation.

To determine the resistance attributing physical characters of sorghum against insect pests the following observations were recorded :

Number of leaves per plant at maturity stage :

Total number of leaves per plant was counted from five randomly selected plants from each net plot and mean number of leaves per plant was worked out.

Plant height at maturity stage :

The plant height from soil surface to tip of ear head was

measured from 5 plants selected randomly from each net plots and mean plant height was worked out.

Leaf size at maturity stage :

To measure the length of leaf, fourth leaf from base was selected. The length of leaf from the base to the tip along the midrib was measured and mean length was calculated.

The breadth of leaf approximately at the middle of leaf was measured.

Number of internodes per plant at maturity stage :

Total number of internodes per plant was counted from five plants randomly selected from each net plot and mean number of internodes per plant was worked out.

Length of internodes at maturity stage :

For this purpose, five plants were randomly selected from each net plot. Mean length of internodes was calculated by

dividing stem length with total number of internodes per plant.

Panicle length at maturity stage :

For this purpose, five plants were randomly selected from each net plot. Panicle length was measured from the base of panicle up to the top of the ear head.

Simple correlations between the above plant characters and insect resistance in sorghum as revealed by dead heart formed was worked out.

RESULTS AND DISCUSSION

The results on mean percentage of dead heart caused by shoot fly during *Rabi* 2006-07 revealed that shoot fly infestation in terms of dead heart ranged between 4.02% to 13.15% with an average of 7.54% (Table 1). Among different genotypes, Nizergoti recorded the significant lowest percentage dead heart (4.02%) followed by SR 1665 (4.25%),

Table 1 : Mean dead heart formation by shoot fly in different sorghum genotypes in *Rabi* season

Sr. No.	Genotype	Mean per cent dead heart		
		2006-07	2007-08	Pooled
1.	SR 655-1	15.98 (7.62)	16.68 (8.30)	16.33 (7.96)
2.	SR 713-1	16.71 (8.38)	16.78 (8.39)	16.74 (8.39)
3.	SR 833-22	21.13 (13.15)	17.65 (9.21)	19.39 (11.18)
4.	SR 1030	18.73 (10.33)	22.31 (14.44)	20.52 (12.38)
5.	SR 1115-1	12.65 (4.82)	19.27 (10.97)	15.96 (7.89)
6.	SR 1638	18.32 (9.93)	17.76 (9.40)	18.04 (9.67)
7.	SR 1657	17.21 (8.83)	19.36 (11.09)	18.29 (9.96)
8.	SR 1665	11.88 (4.25)	17.89 (9.56)	14.88 (6.91)
9.	BP 53	13.45 (5.46)	12.26 (4.56)	12.86 (5.01)
10.	Nizergoti	11.51 (4.02)	11.07 (3.72)	11.29 (3.87)
11.	GJ 36	15.80 (7.46)	16.72 (8.31)	16.26 (7.89)
12.	GJ 38	14.38 (6.24)	13.61 (5.59)	14.00 (5.91)
Mean		7.54	8.63	8.08
S.Em ±		0.947	0.985	1.491
CD @ 5%		2.77	2.88	4.64
CV %		10.49	10.17	10.32

* Figures in parenthesis are retransformed values while those outside are arcsine transformation values

Table 2 : Simple correlations between different physical parameters of sorghum genotypes and incidence of sorghum shoot fly

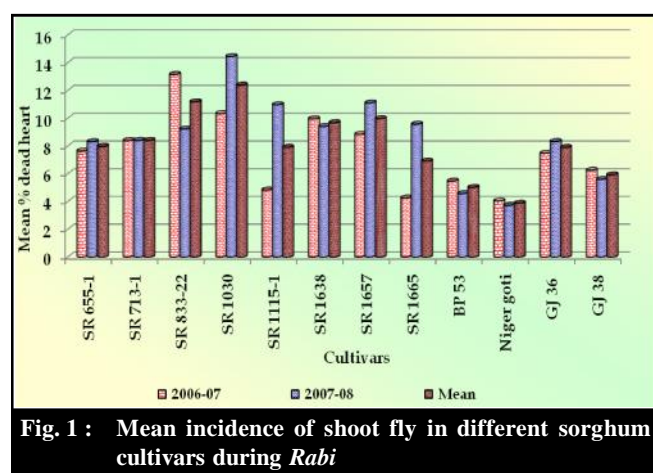
Sr. No.	Plant characters	Shoot fly		
		2006-07	2007-08	Pooled
1.	Plant height	-0.177	-0.281	-0.213
2.	Peduncle length	0.116	0.316*	0.223
3.	Length of leaves	0.244	0.360*	0.272*
4.	Breadth of leaves	-0.068	-0.368*	-0.202
5.	Number of leaves	-0.142	-0.265	-0.255*
6.	Length of internodes	-0.208	-0.380*	-0.226
7.	Number of internodes	0.041	0.117	0.027

* and ** indicates of significance of values at P=0.05 and 0.01, respectively

SR 1115-1 (4.82%) and BP 53 (5.46%) and they were at par with each other. The genotype SR 833-22 recorded significant highest per cent dead heart (13.15%), which was at par with SR 1030 (10.33%). While in *Rabi* 2007- 08 also Nizergoti recorded significantly lower per cent dead heart (3.72%) and it was at par with BP 53 (4.56%) and GJ 38 (5.59%) whereas SR 1030 recorded significantly highest dead heart (14.44%).

The pooled mean over two years (Table 1 and Fig. 1) indicated that minimum shoot fly incidence was recorded in Nizergoti (3.87%) and it was at par with SR 1665 (6.91%), BP 53 (5.01%) and GJ 38 (5.91%). The highest percentage dead heart was recorded in SR 1030 (12.38%) and it was at par with all the varieties except former 4 varieties.

Thus, among all entries tested, Nizergoti (3.87%), followed by BP 53 (5.01%), GJ 38 (5.91%) and SR 1665 (6.91%) were found to be less susceptible compared to other genotypes included in the experiment. Similar reports were made by Anonymous (2005 and 2006) regarding variety GJ 38. According to these reports GJ 38 was least infested by shoot fly as against susceptible check DJ 6514.



Influence of physical characters of sorghum plants on incidence of sorghum pest :

The different plant characters (physical) of 12 sorghum genotypes were correlated with incidence of shoot fly during *Rabi* season and results obtained are presented in Tables 2 and 3. The pooled data of two years *i.e.*, 2006-07 and 2007-08 revealed that the length of leaf had positive and significant correlation with shoot fly susceptibility, whereas number of leaf was found to be significant and negatively correlated with the incidence of shoot fly (Table 2). The study revealed that among the different genotypes, Nizergoti registered less infestation (3.87 % DH). The length of leaf was also less (49.70 cm) and number of leaves was more (8.37) as compared to other genotypes (Table 3). While plant height, breadth of leaves, and length of internodes showed negative and non-

Table 3 : Mean of different physical characters of different cultivars (Rabi)

Sr no	Cultivar	Plant height (cm)		Peduncle length (cm)		Length of leaves (cm)		Breadth of leaves (cm)		Number of leaves		Length of internodes (cm)		Number of internodes								
		2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08							
1.	SR 655-1	91.53	106.80	99.17	22.00	21.13	21.57	60.40	61.6	60.78	5.34	5.57	5.45	7.87	7.20	7.53	11.77	14.22	12.99	7.80	7.53	7.67
2.	SR 713-1	113.60	137.33	125.47	19.00	17.93	18.47	63.78	63.96	63.87	6.08	6.31	6.19	9.33	7.73	8.53	15.37	18.44	16.90	7.47	7.47	7.47
3.	SR 833-22	112.53	131.73	122.13	18.60	19.67	19.13	62.49	59.07	60.78	5.27	5.37	5.32	8.73	7.20	7.97	15.76	20.58	18.67	6.73	6.40	6.57
4.	SR 1030	116.87	110.73	113.80	18.67	18.87	18.77	60.16	61.78	60.97	4.83	4.95	4.89	8.20	7.05	7.63	14.89	15.40	15.14	7.87	7.20	7.53
5.	SR 115-1	124.53	111.53	118.03	19.07	20.47	19.77	62.86	59.49	61.8	5.37	5.59	5.48	9.07	7.00	8.03	18.91	17.11	18.01	6.60	6.53	6.57
6.	SR 1638	124.27	110.53	117.40	20.33	18.80	19.57	60.09	61.29	60.69	4.79	4.85	4.82	7.53	7.13	7.33	15.80	15.25	15.52	7.87	7.27	7.57
7.	SR 1657	130.60	127.13	128.87	19.47	19.80	19.63	60.93	61.31	61.2	4.78	4.91	4.84	7.73	6.67	7.20	14.87	16.03	15.45	8.80	7.93	8.37
8.	SR 1665	106.87	111.93	109.40	19.73	21.33	20.53	57.89	59.55	58.72	4.95	4.76	4.85	8.07	7.20	7.63	12.71	14.35	13.53	8.40	7.80	8.10
9.	BP-53	117.60	119.40	118.50	14.20	12.53	13.37	61.67	59.45	60.36	6.11	5.40	5.75	7.60	6.80	7.20	15.10	17.57	16.84	7.27	6.80	7.03
10.	Nizergoti	152.47	140.33	146.40	17.67	14.27	15.97	50.02	49.38	49.70	4.83	5.21	5.02	8.67	8.07	8.37	19.73	19.13	19.43	7.73	7.33	7.53
11.	GJ 36	103.93	89.93	96.93	22.07	20.33	21.20	59.74	54.71	57.22	6.37	6.12	6.24	7.33	6.27	6.80	17.72	17.80	17.76	5.87	5.07	5.47
12.	GJ 38	110.60	119.87	115.23	21.07	25.27	23.17	66.96	61.49	64.22	5.25	6.01	5.63	9.00	7.73	8.37	15.05	17.83	16.44	7.40	6.73	7.07

significant correlation with shoot fly. The peduncle length and number of internodes, showed positive and non-significant correlation with shoot fly resistance. Similar findings were reported by Prem Kishor *et al.* (1985), Sandhu *et al.* (1986) and Patel and Sukhani (1990). They reported that percentage of dead hearts caused by shoot fly was positively correlated with leaf length and negatively correlated with plant height.

It is rather difficult to pinpoint as to how these physical plant characters determine insect resistance in sorghum plants. Positive correlation between length of leaf and negative correlation between number of leaf to insect resistance, no specific reasons can be given. In all probability the mechanism of non-preference and /or antibiosis may be involved.

Conclusion :

Among all entries tested, Nizergoti (3.87%), followed by BP 53 (5.01%), GJ 38 (5.91%) and SR 1665 (6.91%) were found to be less susceptible compared to other genotypes. Field screening of 12 genotypes of sorghum against major insect pest during *Rabi* 2006-07 and 2007-08 showed that genotypes Nizergoti was found less susceptible to shoot fly, Among different plant characters, length of leaf had positive and

significant correlation with shoot fly susceptibility ($r = 0.272$), whereas number of leaves was found to be significant and negatively correlated with the incidence of shoot fly ($r = -0.255$).

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