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K Jatin
Research Scholar, Department of Entomology, College of Agriculture, R.V.S.K.V.V. Gwalior, Madhya Pradesh, India

Dr. VK Shrivastava
Professor & Head, Department of Entomology, R.V.S.K.V.V, Gwalior, Madhya Pradesh, India

Dr. NKS Bhadauria
Technical Associate, Department of Entomology, R.V.S.K.V.V, Gwalior, Madhya Pradesh, India

Corresponding Author:
K Jatin
Research Scholar, Department of Entomology, College of Agriculture, R.V.S.K.V.V. Gwalior, Madhya Pradesh, India

Evaluation of sorghum (*Sorghum bicolor* L. Moench) genotypes for resistance / Susceptibility to shoot fly

K Jatin, Dr. VK Shrivastava and Dr. NKS Bhadauria

Abstract
The present study was undertaken to estimate the response of various genotypes of sorghum for resistance/susceptibility to shoot fly *Atherigona soccata.* Trial was carried during *kharif* season 2016 with 20 genotypes of sorghum in research Farm College of agriculture Gwalior (M.P). The experiment was conducted in randomized block design with 3 replications. During the experiment observations were recorded on following three characters i.e number of eggs per plant, number of dead hearts produced on 14&21 DAE number of tillers produced were recorded on 35 DAE. This study indicated that dead hearts was positively and significantly associated with number of eggs. The minimum number of eggs 1.35 eggs/ plant was recorded on genotype ICSSH86 which was found to be resistant among all the genotypes. Maximum number of eggs 4.8 eggs/plant was recorded on genotype ICSV25333 was found to be most susceptible. The dead heart observations were recorded on the plant minimum dead hearts was observed in the genotype ICSSH 86 which was found promisingly resistant than rest of the varieties. The maximum number of dead hearts were found on genotype ICSV 25333, which was found susceptible among all the genotypes. The minimum number of tillers were found on the genotype ICSSH86 that promisingly found as resistant to all the genotypes. Maximum number of tillers was recorded on genotype ICSV25333 that was promisingly more susceptible than remaining all the genotypes.

Keywords: Sorghum, shoot fly, genotype, resistant, susceptible

1. Introduction

Sorghum is one of the most important cereal crop cultivated in most places of the world because of its familiarization to a wide range of habitat, low input cultivation and multiple uses. Among the insect pest complex of sorghum, Shoot fly (*Atherigona soccata*) is a serious pest during *Kharif* season in the gird region of Madhya Pradesh. (anon 2016) [1] Based on all India report Shoot fly has been stated to cause an average loss of 5 % (Jotwani, 1983) [5]. In India, the shoot fly has attained the status of a key pest because of the introduction of improved sorghum varieties and hybrids susceptible to this insect, continuous cropping, ratooning, and reduced genetic variability (Singh & Rana, 1986) [10]. It causes dead hearts in early seedling stage reducing plant population, resulting in heavy yield losses upto 75.60 per cent in grain and 68.90 per cent in fodder as discussed by Pawar *et al*. [1984] [9]. It attacks sorghum from 5 to 25 days after seedling emergence. The adult fly lays white, elongated, cigar-shaped eggs singly on the undersurface of the leaves, parallel to the midrib. The eggs hatch in 1-2 days, and the larvae crawl to the plant whorl and then move downward between the folds of the young leaves till they reach the growing point. They cut the growing point and feed on the decaying leaf tissues, resulting in dead heart formation. As a result of shoot fly attack, plant stand is greatly reduced. The death of the main shoot often results in the production of tillers, which often serve as a mechanism of recovery resistance however the tillers are also attacked under high shoot fly pressure. Shoot fly infestation is high when sorghum sowings are staggered due to erratic rainfall distribution, which is common in the semi-arid tropics. Resistant or tolerant genotypes play a major role in reducing the pest attack. Resistant genotype is defined as "the consequence of heritable plant qualities that result in a plant being relatively less damaged than a plant without the qualities. In practical agricultural terms, an insect-resistant genotype is one that produced yield more than a susceptible cultivar when attacked with insect pest. Insect-resistant genotypes suppress insect pest abundance or elevate the damage tolerance level of the plants. Therefore, present study was designed to evaluate the shoot fly reaction in diverse sorghum germplasms by determining the various morpho- physiological traits associated with sorghum shoot fly resistance/ susceptibility.

2. Materials and Methods

Field experiment was laid out in a Randomized block design (RBD) with 20 treatments replicated thrice with a plot size of 5m length of two rows each genotype with a spacing of 45cm between the rows and 12 cm between the plants. Sowing was done on 20 th july 2016 at research farm, college of agriculture, R.V.S krishi maha vidyalaya, Gwalior. All the recommended agronomic practice were followed. The total number of eggs per plant was recorded by randomly selecting 5 plants in each plot at 14 and 21 Days after emergence (DAE). As result of tolerance mechanism, shoot fly produces tillers data recorded on number of tillers produced per plant at 35 DAE and Dead hearts caused by shoot fly was recorded on 14&21 DAE. The percent dead hearts were computed. The data obtained were converted to suitable transformations and were subjected to statistical analysis to test the level of significance.

3. Results and Discussion

3.1 Number of eggs per plant

The results revealed that there was significant difference among genotypes with respect to number of eggs per plant. The minimum number of eggs at 14 DAE (1.3 eggs/plant) were recorded in genotype ICSSH 86 which was significantly less than rest of the genotypes followed by ICSV25335 (1.45eggs/plant).However the maximum number of eggs were recorded on genotype ICSV 25333 (4.2eggs/plant) which was significantly more than rest of the genotypes except ICSV15506 (4.1eggs/per plant) and SPV 2326(4.1eggs/plant)

Number of eggs per plant

S. No	Genotypes	No. of eggs per plant at 14DAE	No. of eggs per plant at 21DAE	Average of 14&21 DAE no. of eggs per plant
1	ICSV 25335	1.45(1.39)*	1.6(1.45)*	1.52(1.42)*
2	ICSSH 87	1.84(1.53)	1.8(1.52)	1.82(1.52)
3	ICSSH 86	1.3(1.34)	1.41(1.38)	1.35(1.36)
4	ICSV 25306	2.6(1.76)	2.3(1.67)	2.45(1.71)
5	ICSSH 82	2.6(1.76)	2.6(1.7)	2.6(1.73)
6	ICSSN 79	3(1.87)	3(1.87)	3(1.87)
7	ICSSH 88	3.2(1.92)	3.1(1.90)	3.15(1.91)
8	DHBM 5	3.15(1.91)	3.3(1.95)	3.22(1.93)
9	DHBM 4	3.4(1.97)	3.2(1.92)	3.3(1.94)
10	DHBM 2	3.1(1.90)	4(2.12)	3.55(2.01)
11	ICSV 25308	2.9(1.84)	4.4(2.21)	3.65(2.02)
12	ICSV 25333	4.2(2.17)	5.4(2.43)	4.8(4.6)
13	ICSV 15006	4.1(2.14)	5.3(2.41)	4.7(2.27)
14	SPV 2326	4.1(2.14)	5.2(2.39)	4.65(2.26)
15	SPV 2327	4(2.12)	5(2.35)	4.5(2.23)
16	SPV 2328	3.8(2.07)	4.8(2.30)	4.3(2.18)
17	DHBM 1	3.6(2.02)	4.6(2.26)	4.1(2.14)
18	DHBM 3	3.5(2.00)	4.52(2.24)	4.01(2.12)
19	SSV 84	3.3(1.95)	4(2.12)	3.65(2.03)
20	CSH 22 SS	3(1.87)	4.2(2.17)	3.6(2.02)
	SEm±	(0.01)	(0.01)	(0.01)
	CD	(0.03)	(0.02)	(0.025)

Similarly, at 21 DAE the different genotypes differed significantly with respect to number of eggs per plant. the minimum and lowest number of eggs was recorded on genotype ICSSH 86 (1.4eggs/plant) which was found significantly less than rest of the genotypes followed by ICSV 25335 (1.6eggs/per plant), on genotype ICSSH 87 (1.8eggs/plant). However maximum number of eggs was recorded on genotype ICSV25333 (5.4eggs/plant) which was significantly more than rest of the genotypes except ICSV15006 (5.3eggs/plant), SPV2326 (5.2eggs/plant), and SPV2327 (5eggs/plant). On the basis of average of the both of the observation i.e., 14 and 21DAE the different genotypes differed significantly with respect to number of eggs. The minimum number of eggs 1.35 eggs/plant was recorded in genotype ICSSH 86 which was found significantly less than rest of the genotypes except ICSV 25335 these genotypes stood as promisingly resistant. However the maximum number of eggs was recorded in genotype ICSV 25333 which was found significantly more than all the genotypes except ICSV15006 recorded as most susceptible genotype. The present findings were in accordance with findings reported by Jotwani *et al.* (1971) [8], Teli *et al*. (1983) [11] Deshpande *et al*. (2003) [3], Kumar *et al*. (2003) [7].

3.2 Number of tillers produced by shoot fly

Data recorded on number of tillers produced per plant as a result of shoot fly infestation at 35 DAE (days after emergence). The minimum number of tillers was recorded on genotype ICSSH 86 (1.2tillers/plant) which was found significantly less than the rest of the genotypes, followed by genotype ICSV 25335(1.5tillers/plant) and ICSSH 87(1.6tillers/plant).However the maximum and highest number of tillers were recorded in the genotype ICSV 25333 (6tillers/plant) which was significantly more than rest of the genotypes except ICSV 15006 (5.4tillers/plant) ICSV 15006,(5.3tillers/plant) and SPV 2327 (5.2tillers/plant) the present findings were in accordance with Kimhaeko *et al*. (2010) and Dhillon *et al* (2005) [4].

Number of tillers produced by shoot fly

S. No	Genotypes	35 DAE
1	ICSV 25335	1.5(1.41)*
2	ICSSH 87	1.6(1.45)
3	ICSSH 86	1.2(1.30)
4	ICSV 25306	2(1.58)
5	ICSSH 82	3(1.87)
6	ICSSN 79	2.5(1.73)
7	ICSSH 88	2.7(1.79)
8	DHBM 5	3.2(1.92)
9	DHBM 4	2.1(1.61)
10	DHBM 2	3.6(2.02)
11	ICSV 25308	4(2.12)
2	ICSV 25333	6(2.55)
13	ICSV 15006	5.4(2.43)
14	SPV 2326	5.2(2.39)
15	SPV 2327	5.3(2.41)
16	SPV 2328	4.2(2.17)
17	DHBM 1	4.4(2.21)
18	DHBM 3	4.6(2.26)
19	SSV 84	4.8(2.30)
20	CSH 22 SS	4.3(2.19)
	SEm±	(0.01)
	CD	(0.02)

3.3 Per cent dead hearts caused by shoot fly in different genotypes

The minimum dead heart percentage at 14 DAE was recorded on genotype ICSSH 86 (8.45) it was significantly less than rest of the genotypes followed by ICSV 25306(8.47) and DHBM3 (8.65). However the maximum and significantly higher percentage of dead heart was recoded in genotype ICSV 25333 (39.01), which showed significantly higher dead hearts as compared than rest of the genotypes except ICSSH82 (30.7), ICSSH 87(28.43) and genotype SPV 2326(28.43).

Per cent dead hearts caused by shoot fly in different genotypes

S.no	Genotypes	Percent dead heart at 14 DAE	Percent dead heart at 21 DAE	Average of 14&21 DAE
1	ICSV 25335	22.87(28.57)*	33.58(35.41)*	28.27(31.99)*
2	ICSSH 87	28.43(32.22)	37.29(37.64)	32.86(34.93)
3	ICSSH 86	8.45(16.87)	14.02(21.97)	11.23(19.42)
4	ICSV 25306	8.47(16.90)	17.1(24.42)	12.78(20.66)
5	ICSSH 82	30.7(33.64)	42.23(40.53)	36.46(37.08)
6	ICSSN 79	14.22(22.14)	23.4(28.92)	18.81(25.53)
7	ICSSH 88	25.75(30.49)	49.9(44.94)	37.82(37.71)
8	DHBM 5	14.22(22.14)	22.05(28.00)	18.13(25.07)
9	DHBM 4	12.2(20.43)	14.15(22.08)	13.17(21.25)
10	DHBM 2	11.53(19.83)	17.3(24.57)	14.41(22.2)
11	ICSV 25308	16.3(23.81)	24.95(29.96)	20.6(26.88)
12	ICSV 25333	39.01(38.65)	46.17(42.80)	42.59(40.72)
13	ICSV 15006	11.33(19.66)	46.07(42.75)	28.7(31.02)
14	SPV 2326	28.43(32.22)	30.72(33.65)	29.57(32.93)
15	SPV 2327	19.78(26.40)	22.07(28.02)	20.9(27.2)
16	SPV 2328	22.05(28.00)	17.3(24.57)	19.6(26.2)
17	DHBM 1	17.3(24.57)	14.22(22.15)	15.76(23.36)
18	DHBM 3	8.65(17.06)	15.09(22.85)	11.87(19.95)
19	SSV 84	17.3(24.57)	17.09(24.41)	17.19(24.49)
20	CSH 22 SS	23.07(28.70)	23.07(28.70)	23.07(28.7)
	SEm±	(0.29)	(0.30)	(0.29)
	CD	(0.83)	(0.85)	(0.84)

Similarly at 21 DAE the minimum and lower percentage of dead hearts was recorded in genotype ICSSH 86(14.02) which was significantly less than rest of the genotypes, followed by DHBM4(14.15) and DHBM1(14.22). However, the maximum and significantly higher dead heart percentage was recorded on genotype ICSSH88 (49.9) which was significantly more than rest of the genotypes. Except ICSV25333 (46.17) and ICSV15006 (46.07). Average of 14&21 DAE was positively correlated with the observations at 14&21 DAE. The present findings were in accordance with findings reported by Chamarthi *et al* (2011) [2], Vyas *et al*. (2014) [12] and Vyas *et al*. (2014a) [12], Singh and Grewal (1997), Kumar *et al*. (2000) [6].

4. Conclusion
Finally it is concluded that genotype ICSSH 86 was found resistant to the shoot fly damage followed by ICSV 25335, DHBM3 and ICSV 15006. These genotypes can be used in breeding programmes for shoot fly resistance. Investigation on morphological characters conferring resistance to key pests needs to be intensified. Physiological and biochemical assessment studies of genotypes should be conducted for antibiosis mechanism against sorghum pest.

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