The Pharma Innovation Journal 2021; 10(12): 134-138

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(12): 134-138

www.thepharmajournal.com
Received: 10-09-2021
Accepted: 18-11-2021

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Screening and biochemical evaluation of different sorghum genotypes for shoot fly resistance

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Abstract
The present study entitled, Screening and biochemical evaluation of different sorghum genotypes for shoot fly resistance was carried out during *Rabi* 2020-21. Observations were made on plant population per cent, seedling vigour, leaf glossiness, days required to 50% flowering, trichome density, shoot fly eggs per five plants, shoot fly dead hearts, stem borer dead heart, soluble protein content, total chlorophyll content, polyphenol oxidase and peroxidase activity and yield. The results of experiment revealed that, Lowest dead hearts per cent caused by shoot fly at 28 DAE were recorded by the test entries RSV-2394, RSV-2388 and RSV-2395 were 14.41%, 15.38%, 15.72% respectively. These test entries might be considered as resistant lines to shoot fly. The promising test entries RSV-2394, RSV-2388, RSV-2395 also recorded lowest soluble protein and total chlorophyll content along with the maximum peroxide and PPO activity which were at par with the shoot fly sorghum resistant checks IS-18551, IS-2205 and local check RSV-1188.

Keywords: Sorghum shoot fly, *Atherigona soccata*, dead hearts, trichome density

Introduction
Sorghum is one of the foremost significant cereal crop in semi-arid tropics (SAT) and therefore the fifth most vital cereal crop universally after wheat, rice, maize as well as barley (Bantilan *et al*., 2004) [3]. More than half of the world's sorghum is grown in the semi-arid regions and it is fundamental food for over 500 million people who live in the semi-arid tropics (Mohammed *et al.*, 2015) [9]. Sorghum is one of the foremost effective crops in terms of solar power conversion and water utility as well as being an intense energetic, drought tolerant and environmentally friendly crop and because of its many applications and adaptations sorghum is considered "One of the truly indispensable crops" essential for survival of the humankind. Sorghum contains such a high content of starch, sugar and fiber and is among the foremost important energy crop across universe. The USA, Nigeria, Ethiopia, India and Mexico are the top sorghum producers, producing 8.67, 6.66, 5.20, 4.73 and 4.32 million tons production respectively (Anonymous, 2020) [1]. India is the largest sorghum grower in the world with an average area 4824 thousand hectares, production 4772 thousand tons and productivity 989 kg/ha (Anonymous, 2020) [1] and according to the third advance estimates of 2020-21, the sorghum production in India is 4800 thousand tons. From seedling to harvesting stage of sorghum crop there are about 150 different insect pests which infest the sorghum. Among the different pests of sorghum Shoot Fly *Atherigona soccata* (Diptera: Muscidae), is one of the major constraint in production of sorghum during the seedling stage of the crop (Aruna and Padmaja, 2009) [2]. Shoot fly infests the sorghum seedlings at seventh days after emergence, while the infestation lasts till the 30 DAE of the crop (Vadariya, 2014) [16]. The determination of the mechanism of insect resistance, as well as the probable morphological and biochemical characters that may be associated to the resistance mechanism is an important part of insect resistance in crop. Because of its limited monetary returns sorghum crop necessitates need based plant protection approach as this crop cannot afford the higher plant protection costs. Keeping in view the importance of these aspects for protection against the shoot fly, the present investigations were carried out

Materials and Methods
Experimental details
A field study was conducted to screen different genotypes of sorghum against sorghum shoot fly during *Rabi*2020-21 under randomized block design (RBD) at Sorghum Improvement Project, MPKV, Rahuri, Dist. Ahmednagar (M.S.) with 14 genotypes along with checks and

were replicated thrice with a spacing of 45cm x 15 cm in the plot size of 4 m x 2.7 m. The observations were recorded for each genotype on physical traits such as plant population (%), seedling vigour, leaf glossiness, days required to 50 per cent flowering. The observations are also recorded on trichome density (No.mm^{-2}), number of eggs per five plants, dead heart (%) at 14 and 28 DAE due to shoot fly infestation and yield. For biochemical evaluation the fourteen genotypes of *Rabi* sorghum were grown in pots and total chlorophyll content, soluble protein content, peroxidase and PPO activity were analyzed from leaf tissues in laboratory.

Results and Discussion

Screening of different genotypes of sorghum against sorghum shoot fly

Per cent Plant Population (12 DAE)

Per cent plant population of entries was counted at 12 DAE from germinated plants in each row and it could be noticeable from table that data recorded was statistically significant between the various genotypes (Table 1). The overall plant population at 12 DAE varied from 84.61 to 96.15. The higher plant population per cent observed in test entries RSV 2394 (96.15%), RSV-2388 (92.30%) indicating that they were at par with resistant check IS-18551 (91.02%). Test entries RSV-2395 (91.02%), RSV-2399 (89.74%), susceptible check Swarna (89.74%) followed by the test entries RSV-2408 (88.46%), RSV-2419 (88.46%), resistant check IS-2205 (87.18%), RSV-1988 (87.18%), local check RSV-1188 (87.17%), test entries RSV-2371 (87.17%), RSV-1941 (85.89%) and DJ 6514 susceptible check (84.61%) were at par with each other.

Seedling Vigour

It was observed that there was a substantial variation in seedling vigour among the resistant checks and genotypes (Table 1). The seedling vigour recorded was ranged from 1.33 to 4.00. Seedling vigour (1.33) was maximum in test entry RSV -2388 and local check RSV-1188 at 12 days after emergence. The IS-18551 and IS-2205 recorded higher seedling vigour of 1.67 at 12 DAE, while the susceptible check DJ-6514 recorded lowest seedling vigour of 4.00. These outcomes are in line with Bhagwat *et al*. (2011) [5] found that the genotypes IS-2312, IS-18551 and IS-2205 possess highest seedling vigour 2.3, 2.2 and 2.4 respectively. The test entry RSV-2388 and local check RSV-1188 recorded maximum score of seedling vigour *i.e.,* 1.33 which were at par with resistant checks IS-18551 and IS-2205 (1.67), test entries RSV-2394, RSV-2371, RSV-1941 which recorded 1.67 and RSV-1988 which recorded 2.00 score, while the genotypes RSV-2395, RSV-2419 recorded 2.67 score. The minimum score is recorded by the genotypes RSV-2399 (3.33), RSV-2408 (3.67) and susceptible check Swarna (3.67). The lowest score was recorded by the susceptible check DJ-6514 (4.00).

Leaf Glossiness

Glossiness of leaves appeared as one among the important morphological character for shoot fly resistance. From the present work, it was stated that there was significant difference in leaf glossiness within the resistant checks and test entries (Table 1). The leaf glossiness score was ranged from 1.00 to 3.33 which were recorded at 14 DAE. The leaf glossiness was highest *i.e.,* 1.00 in resistant check IS-2205 as well as the resistant check IS-18551 and the local check RSV-1188 recorded higher leaf glossiness *i.e.,* 1.33. The present outcomes are in correspondence with the reports of Chamurthi *et al*. (2010) [7], Sonalkar and Pagire (2017) [15] and Sekar *et al.* (2018) [14] who concluded that cultivars with greater glossiness of leaf were less susceptible to shoot fly attack.

Trichome Density (No.mm^{-2})

Trichome density of test entries recorded at 14 DAE (days after emergence) and according to the present findings data obtained was statistically significant which was ranged from 0.28 to 13.98 No.mm^{-2}. Trichome density was recorded maximum in test entries RSV-2394 (13.98 No.mm^{-2}) indicating at par with RSV-2388 (13.90 No.mm^{-2}), RSV-1188 (13.87 No.mm^{-2}), RSV-2395 (13.05 No.mm^{-2}), RSV-2399 (12.80 No.mm^{-2}), IS-18551 (12.68 No.mm^{-2}), RSV-2408 (11.79 No.mm^{-2}), RSV-2371 (11.52 No.mm^{-2}) and RSV- 1988 (11.50 No.mm^{-2}). The test entries RSV- 1941 (8.25 No.mm^{-2}) and RSV- 2419 (7.56 No.mm^{-2}) recorded minimum trichome density among the test entries. The present observations indicated that trichome trait may be playing a certain role in infestation and damage caused by shoot fly by interfering oviposition, locomotion as well as survival of first instars larvae of shoot fly. These outcomes are in correspondence with Raina *et al.* (1984) [13] who observed the more trichome density on the resistant lines, while no trichome were observed in susceptible lines.

Shoot Fly Eggs per Five Plants (No.) at 14 DAE

Shoot fly eggs per five plants were counted at 14 DAE and the data obtained was statistically significant which ranged from 1.00 to 6.00. The minimum numbers of eggs per five plants were observed on resistant checks IS-18551 (1.00). The IS-2205 (1.33) resistant check and RSV- 1188 (1.33) also recorded the minimum number of eggs indicating that they were at par with the test entries RSV-2394 (2.00), RSV-2388 (2.33), RSV-2371 (2.33). The present observations indicated that the lower numbers of eggs were laid on the less susceptible test entries in comparison to highly susceptible entries. The present outcomes are in correspondence with the Patel *et al.* (2016) [10] who concluded that the genotypes IS-18551 and IS-2205 recorded lowest shoot fly oviposition and incidence.

Shoot Fly Dead Heart percent at 14 DAE

During the present investigation, it was observed that per cent dead heart due to shoot fly was ranged from 6.80% to 25.00% at 14 DAE and the data obtained was significantly differed among the genotypes. Among the fourteen test entries, resistant checks IS- 18551 (6.80%) recorded the lowest dead hearts per cent followed by IS-2205 (7.30%) and RSV-1188 (8.60%). Among the test entries RSV-2394 (8.80%) recorded the lower dead hearts which was at par with RSV-2388 (9.60%), RSV-2395 (11.00%) and these entries were considered to be promising. Other test entries RSV-2399 (12.00%), RSV-2371 (14.00%), RSV-1941 (15.00%), RSV-1988 (16.00%), RSV-2419 (16.80%), RSV-2408 (20.10%) were at par with each other and also recorded lower dead hearts percentage than the susceptible checks DJ-6514 (20.00%) and Swarna (25.00%).

Shoot Fly Dead Heart percent at 28 DAE

The per cent dead heart because of shoot fly was varied from 11.97% to 64.00% at 28 DAE and differed significantly among the genotypes. Among the fourteen test entries,

resistant check IS-18551 (11.97%) recorded the lowest dead hearts per cent subsequently by IS-2205 (12.60%). The test entries RSV-2394 (14.41%), RSV-2388 (15.38%) and RSV-2395 (15.72%) were considered to be promising and recorded lowest dead heart percentage and these genotypes were at par with local check RSV-1188 (14.00%). Other test entries RSV-2399 (22.04%), RSV-2419 (24.72%), RSV-1941 (26.00%), RSV-2371 (26.06%), RSV-1988 (27.00%), RSV-2408 (36.66%) also recorded lower dead hearts percentage than the susceptible checks DJ-6514 (60.00%) and Swarna (64.00%). The present outcomes are in correspondence with the outcomes of Patil and Bagde (2017) [11] who reported that there was significantly lower number of eggs on the resistant checks *viz*., IS-2312 recording 0.12 nos./ seedling, IS-2205 recording 0.13 nos./seedling, IS-18551 recording 0.14 nos./seedling and the lower per cent dead hearts of 5.27, 6.21 and 6.03 per cent, respectively on IS-2312, IS-2205 and IS-18551.

Grain Yield

The recorded data on grain yield from the present investigation represented in Table 2 which indicates five plants mean grain yield of each genotype in gram and was ranged from 95.00 to 298.67. Significantly maximum grain yield recorded in test entry RSV-2371 (298.67 g) followed by RSV-2388 (285.33 g), RSV-2394 (282.00 g) which were at par with each other followed by RSV-1988 (220.00 g), RSV-1188 (213.33 g), RSV-2395 (201.67 g) which were at par with each other. The test entries RSV-2399 (193.33 g), RSV-2419 (188.00 g), RSV-2408 (170.67 g), RSV-1941 (155.67 g) and susceptible check Swarna (149.67 g) also registered higher grain yield, while substantially lower grain yield was registered in DJ-6514 susceptible check (53.00 g), resistant check IS-18551 (95.00 g) and IS-2205 (105.00 g).

Fodder Yield

The data recorded on fodder yield (kg) in fourteen genotypes were presented in Table 2 and it was ranged from 1.21 to 2.00 kg. Significantly maximum fodder yield was observed in the test entry RSV- 2371 (2.00 kg) and next higher fodder yield was observed in the test entries, RSV 2388 (1.96 kg), RSV-2394 (1.88 kg), local check RSV-1188 (1.86 kg) which were at par with each other, followed by RSV 1941 (1.64 kg), RSV-2399 (1.63 kg), RSV-1988 (1.60 kg), RSV-2395 (1.52 kg) and were also at par with one another. The test entries RSV-2419 (1.45 kg), RSV-2408 (1.34 kg), resistant check IS-18551 (1.31 kg) also recorded higher fodder yield. Substantially lower yield of fodder was observed in Swarna susceptible check (1.21kg), resistant check IS-2205 (1.25 kg) and susceptible check DJ-6514 (1.27 kg).

Biochemical evaluations of *rabi* sorghum genotypes for shoot fly resistance

Soluble Protein

The data recorded on soluble protein content of each genotype at 14 DAE is presented in Table 3 which ranged from 1.05 to 1.55 mg/gm of tissue and it was statistically significant. The lowest soluble protein content was recorded in the test entry RSV-1988 (1.05 mg/gm tissue), local check RSV-1188 (1.08 mg/gm tissue), test entries RSV-2394 (1.11 mg/gm tissue) and RSV-1941 (1.12 mg/gm tissue). The higher protein content was observed in DJ-6514 shoot fly susceptible check (1.49mg/gm tissue), test entry RSV-2408 (1.52mg/gm tissue), while the highest protein content 1.55 mg/gm of tissue was observed in susceptible check Swarna.

The data recorded on soluble protein content of each genotype at 28 DAE is presented in Table 3 which ranged from 1.30 to 2.33 mg/gm of tissue and it was statistically significant. The lowest protein content 1.30mg/gm of tissue was observed in IS-18551 resistant check and was at par with local check RSV-1188 (1.35mg/gm tissue), test entries RSV-2394 (1.35mg/gm tissue), RSV-2395 (1.36mg/gm tissue), resistant check IS-2205 (1.37mg/gm tissue) and test entry RSV-2388 (1.38mg/gm tissue). The higher protein content was recorded in susceptible check DJ-6514 (2.28mg/gm tissue) and in test entry 2408 (2.31mg/gm tissue). The maximum protein content 2.33mg/gm of tissue was found in susceptible check Swarna. From the present outcomes it was concluded that the shoot fly susceptible entries had the highest protein content as compared to resistant one. The present outcomes are in correspondence with Bhise *et al.* (1996) [6] who concluded that susceptible check CSH-1 contain highest protein, while the resistant variety IS-5490 had lowest protein content.

Total Chlorophyll

Data was recorded on total chlorophyll content of each sorghum genotype at 14 DAE and presented in Table 3 which was ranged from 1.33 to 1.68 mg/gm of tissue and it was statistically significant. Minimum chlorophyll content was registered in test entries RSV-2394 (1.33 mg/gm tissue), RSV-2419 (1.37 mg/gm tissue) followed by resistant check IS-18551 (1.39 mg/gm tissue) was at par with test entries RSV-2388, RSV- 2395 both recorded 1.41 mg/gm of tissue total chlorophyll content, also with local check RSV-1188 (1.42 mg/gm tissue), resistant check IS-2205 (1.43 mg/gm tissue) and test entry RSV-2399 (1.43 mg/gm tissue).

The data recorded on total chlorophyll content of each genotype at 28 DAE and presented in Table 3 which was statistically significant and ranged from 1.52 to 2.10 mg/gm of tissue. The lowest chlorophyll content was recorded in test entries RSV-2419 (1.52 mg/gm of tissue), RSV-2395 (1.59 mg/gm tissue) and RSV-2394 (1.60 mg/gm tissue) followed by RSV-2388 (1.66 mg/gm tissue) being at par with resistant check IS-18551 (1.75 mg/gm tissue), local check RSV-1188 (1.76 mg/gm tissue) and resistant check IS-2205 (1.80 mg/gm tissue). The higher chlorophyll content was noticed in Swarna (2.02 mg/gm tissue) and DJ-6514 (2.10 mg/gm tissue). The present outcomes are in association with Mate *et al.* (1988) [8] discovered that increasing chlorophyll content enhanced susceptibility to shoot fly because shoot fly larvae prefer more chlorophyll. According to Patil *et al.* (2006) [12] the reduced chlorophyll content causes the leaves to appear yellowish green, making them unattractive for oviposition of shoot fly.

Peroxidase Activity

Peroxidase activity for sorghum genotypes was estimated at 14 DAE and data obtained is tabulated in Table 3 which was statistically significant. The data obtained on peroxidase activity was ranged from 1.02 to 1.38 Δ O.D./min/g of tissue. The maximum peroxidase activity 1.38 Δ O.D./min/g of tissue was observed in local check RSV-1188 being at par with test entries RSV-2394 (1.30 Δ O.D./min/g tissue), RSV-2419 (1.30 Δ O.D./min/g tissue), RSV-2395 (1.29 Δ O.D./min/g tissue), resistant checks IS-2205 (1.29 Δ O.D./min/g tissue), IS-18551 (1.22 Δ O.D./min/g tissue) and test entry RSV-2388 (1.22 Δ O.D./min/g tissue). The minimum activity was found in test entry RSV-1988 (1.08 Δ O.D./min/g tissue) and in susceptible check Swarna (1.08 Δ O.D./min/g tissue). The

lowest peroxidase activity was recorded in susceptible check DJ-6514 (1.02 Δ O.D./min/g tissue).

Polyphenol oxidase Activity

The polyphenol oxidase activity of each genotype was calculated at 14 DAE and data obtained is presented in Table 3 which was statistically significant. The data obtained on PPO activity was ranged from 0.21 to 0.41 Δ O.D./min/g of tissue. The greater PPO activity was registered in local check RSV-1188 (0.41 Δ O.D./min/g tissue), RSV-2419 (0.40 Δ O.D./min/g tissue) and in resistant check IS-2205 (0.38 Δ O.D./min/g tissue). The minimum activity was recorded in susceptible check DJ-6514 (0.23Δ O.D./min/g tissue) and in entry RSV-1941 (0.21Δ O.D./min/g tissue).

The polyphenol oxidase activity of each genotype was calculated at 28 DAE and data obtained is presented in Table 3 which was statistically significant. The data obtained on PPO activity was varied from 0.38 to 0.95 Δ O.D./min/g of tissue. The maximum PPO activity was observed in test entries RSV-2395 (0.95 Δ O.D./min/g tissue), RSV-2419 (0.85 Δ O.D./min/g tissue), RSV-2388 (0.81Δ O.D./min/g tissue), RSV-2394 (0.80Δ O.D./min/g tissue), local check RSV-1188 (0.80Δ O.D./min/g tissue), IS-18551 (0.78Δ O.D./min/g tissue) and IS-2205 (0.75Δ O.D./min/g tissue). The minimum activity was recorded in susceptible check Swarna (0.42) while the lowest recorded in DJ-6514 (0.38Δ O.D./min/g tissue).

The cultivars of sorghum with increased PPO and peroxidase activity were shown to be less susceptible to shoot fly infestation. Similar outcomes were also reported by Bapat *et al.* (1987) [4] and Bhise *et al.* (1996) [6] who concluded that resistant cultivars had higher activities of PPO and peroxidase which is followed by moderately susceptible lines and more susceptible lines of sorghum.

Table 1: Screening of sorghum cultivars for morphological characters against shoot fly (*Atherigona soccata* Rondani)

Sr. No.	Genotypes	Plant population (%) (12 DAE)*	Seedling Vigour (1-5) (12 DAE)	Leaf Glossiness (1-5) (14 DAE)	Days required to 50% flowering
1	RSV 1941	85.89 (68.06)	1.67	3.00	100
2	RSV 1988	87.18 (69.03)	2.00	2.67	95.33
3	RSV 2371	87.17 (69.20)	1.67	2.00	94.33
4	RSV 2388	92.30 (74.21)	1.33	2.00	91.67
5	RSV 2394	96.15 (80.84)	1.67	1.67	105.33
6	RSV 2395	91.02 (72.61)	2.67	2.33	104.67
7	RSV 2399	89.74 (71.36)	3.33	2.00	96.00
8	RSV 2408	88.46 (70.28)	3.67	2.00	96.67
9	RSV 2419	88.46 (70.28)	2.67	3.00	95.33
10	IS 18551	91.02 (72.96)	1.67	1.33	104.67
11	RSV 1188	87.17 (69.20)	1.33	1.33	94.00
12	IS 2205	87.18 (69.03)	1.67	1.00	101.00
13	DJ 6514	84.61 (66.98)	4.00	3.33	93.33
14	Swarna	89.74 (71.53)	3.67	3.00	92.33
	S.Em ±	2.33	0.35	0.42	1.25
	C.D. at 5%	6.81	1.03	1.24	3.65

DAE: Days after emergence

*The values in parentheses indicate arcsine values

Table 2: Screening of sorghum genotypes to oviposition, dead hearts caused by shoot fly (*Atherigona soccata* Rondani) and yield

Sr. No	Genotypes	Trichome density** (No.mm^{-2})	Shoot fly eggs/five plants (No.) (14 DAE)**	Shoot fly dead hearts (%)*		Yield/5 plants	
				14 DAE	28 DAE	Grain (gm)	Fodder (kg)
1	RSV 1941	8.25 (3.04)	3.67 (2.16)	15.00 (22.75)	26.00 (30.63)	155.67	1.64
2	RSV 1988	11.50 (3.53)	4.00 (2.23)	16.00 (23.54)	27.00 (31.27)	220.00	1.60
3	RSV 2371	11.52 (3.54)	2.33 (1.82)	14.00 (21.91)	26.06 (30.65)	298.67	2.00
4	RSV 2388	13.90 (3.86)	2.33 (1.82)	9.60 (18.03)	15.38 (23.08)	285.33	1.96
5	RSV 2394	13.98 (3.87)	2.00 (1.72)	8.80 (17.23)	14.41 (22.30)	282.00	1.88
6	RSV 2395	13.05 (3.75)	3.00 (1.99)	11.00 (19.36)	15.72 (23.35)	201.67	1.52
7	RSV 2399	12.80 (3.71)	2.67 (1.90)	12.00 (20.22)	22.04 (27.97)	193.33	1.63
8	RSV 2408	11.79 (3.57)	4.33 (2.31)	20.10 (26.61)	36.66 (37.24)	170.67	1.34
9	RSV 2419	7.56 (2.92)	3.67 (2.16)	16.80 (24.17)	24.72 (29.80)	188.00	1.45
10	IS 18551	12.68 (3.69)	1.00 (1.41)	6.80 (15.11)	11.97 (20.22)	95.00	1.31
11	RSV 1188	13.87 (3.85)	1.33 (1.52)	8.60 (17.04)	14.00 (21.96)	213.33	1.86
12	IS 2205	11.47 (3.53)	1.33 (1.52)	7.30 (15.66)	12.60 (20.78)	105.00	1.25
13	DJ 6514	0.28 (1.13)	5.33 (2.52)	20.00 (26.54)	60.00 (50.76)	53.00	1.27
14	Swarna	1.73 (1.65)	6.00 (2.64)	25.00 (29.98)	64.00 (53.12)	149.67	1.21
	S.Em ±	0.12	0.11	0.74	0.79	5.86	0.04
	C.D. at 5%	0.34	0.33	2.15	2.30	17.12	0.12

DAE: Days after Emergence

*The values in parentheses indicate arcsine values.

**The values in parentheses indicate $\sqrt{n+0.5}$ value.

Table 3: Soluble protein and total chlorophyll content in *rabi* sorghum genotypes for shoot fly resistance at different growth stages

Sr. No.	Genotypes	Soluble protein (mg/gm tissue)		Total chlorophyll (mg/gm tissue)		Peroxidase Activity (Δ O.D./min/g)		PPO Activity (Δ O.D./min/g)	
		14 DAE	28 DAE	14 DAE	28 DAE	14 DAE	28 DAE	14 DAE	28 DAE
1	RSV 1941	1.12	1.52	1.60	1.99	1.10	1.40	0.21	0.46
2	RSV 1988	1.05	1.50	1.44	1.90	1.08	1.33	0.29	0.48
3	RSV 2371	1.26	1.59	1.55	1.94	1.17	1.46	0.30	0.51
4	RSV 2388	1.29	1.38	1.41	1.66	1.22	1.75	0.27	0.81
5	RSV 2394	1.11	1.35	1.33	1.60	1.30	1.81	0.29	0.80
6	RSV 2395	1.16	1.36	1.41	1.59	1.29	1.89	0.31	0.95
7	RSV 2399	1.24	1.48	1.43	1.88	1.11	1.41	0.26	0.55
8	RSV 2408	1.52	2.31	1.49	1.98	1.10	1.33	0.30	0.59
9	RSV 2419	1.21	1.46	1.37	1.52	1.30	1.85	0.40	0.85
10	IS 18551	1.14	1.30	1.39	1.75	1.22	1.75	0.33	0.78
11	RSV 1188	1.08	1.35	1.42	1.76	1.38	1.89	0.41	0.80
12	IS 2205	1.18	1.37	1.43	1.80	1.29	1.88	0.38	0.75
13	DJ 6514	1.49	2.28	1.56	2.10	1.02	1.30	0.23	0.38
14	Swarna	1.55	2.33	1.68	2.02	1.08	1.35	0.28	0.42
	S.E.m ±	0.05	0.05	0.06	0.05	0.06	0.06	0.03	0.05
	C. D. at 5%	0.14	0.15	0.16	0.16	0.18	0.16	0.09	0.15

DAE: Days after Emergence

Conclusions

Lowest dead hearts per cent caused by shoot fly at 28 DAE were recorded by the test entries RSV-2394, RSV-2388 and RSV-2395 were 14.41%, 15.38%, 15.72% respectively. These test entries might be considered as resistant lines to shoot fly. The promising test entries RSV-2394, RSV-2388, RSV-2395 also recorded lowest soluble protein and total chlorophyll content along with the maximum peroxide and PPO activity which were at par with the shoot fly sorghum resistant checks IS-18551, IS-2205 and local check RSV-1188.

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