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Survey and screening of sorghum germplasms against anthracnose disease

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Abstract

Sorghum is the fifth most important world cereal crop after wheat, rice, maize and barley. Anthracnose caused by *Colletotrichum graminicola* (Ces.) Wilson is one of the most destructive foliar diseases. Considering this, the present investigation was carried out through survey of anthracnose disease of sorghum to measure intensity and distribution of in three talukas of Banaskantha district viz., Dantiwada, Deesa and Palanpur and screened the germplasms in the field conditions against anthracnose disease during *kharif*, 2017. The survey revealed that anthracnose disease was more severe in Dantiwada taluka (56.29 %) than Deesa (52.96 %) and Palanpur (47.78 %) talukas. Fifty sorghum germplasms were screened under field conditions against anthracnose disease of sorghum. Among them, twenty one germplasms were found susceptible, 6 germplasms were found highly susceptible, 16 germplasms were moderately resistant and seven germplasms showed resistant reaction [FM-303, 1013-4 (C-43 × UPMC-512), EJM-26, EJM-203, ER-23, ER-25 and CSV-17 × SPV-2133].

Keywords: Sorghum, anthracnose, *Colletotrichum graminicola*, germplasm

1. Introduction

Sorghum is one of the world's leading cereal crops. Sorghum is used for food, fodder and the production of alcoholic beverages (Reddy *et al.*, 2006)^[7]. Sorghum is grown in areas receiving 500 to 1000 mm annual rainfall with the temperature requirement of 26 °C to 32 °C. (Rao *et al.*, 2004)^[6]. Sorghum is susceptible to many diseases, among them, foliar diseases of fungal origin prevalent in India are rust, downy mildew, anthracnose, zonate leaf spot, leaf blight, grey leaf spot, sooty stripe and tar spot (Sharma *et al.*, 1978)^[8]. Anthracnose initially produced small, red, purple or brown spots with whitish or purple centers. The spots are elliptical or spindle shaped 2 to 4 mm long and 1 to 2 mm broad, surrounded by well-defined margin. The affected young seedling shows blighting. Infection is localized, fungus produce acervuli (Rangaswami and Mahadevan, 2010)^[5]. Losses in grain yield of sorghum due to foliar diseases ranged from 32 to 60 per cent (Chesser *et al.*, 1959)^[2]. The grain loss caused by anthracnose disease varies from region to region. It has been reported to be 1.2 to 16.4 per cent in India (Mishra and Siradhana, 1979)^[4]. So it is necessary to develop suitable management practices. Considering this, the present investigation on survey of anthracnose disease was carried out in three talukas of Banaskantha district of Gujarat. Economic returns from this resource poor sorghum crop are meagre; growing resistant varieties is the only alternative for combating this important foliar disease. Therefore, it becomes necessary to screen the germplasms.

2. Materials and Methods

2.1 Survey of anthracnose disease of sorghum in Banaskantha district

The survey was conducted in second week of September during *kharif*, 2017 to know the incidence and severity of anthracnose of sorghum in the farmer fields of Dantiwada, Deesa and Palanpur talukas of Banaskantha district. In each taluka, three villages were covered. In each village, five farmer fields were observed. The severity of anthracnose of sorghum in each field was recorded by using 1 to 9 scales given by Wheeler (1969)^[11]. Per cent disease intensity was calculated by following formula (Wheeler, 1969)^[11].

$$\text{PDI} = \frac{\text{Sum of numerical rating}}{\text{Total number of plants observed} \times \text{Highest disease scale}} \times 100$$

2.2 Screening of sorghum germplasms against anthracnose disease

Fifty Sorghum germplasms were collected from the Sorghum Research Station, S.D. Agricultural University, Deesa. The germplasms were screened at Agronomy Instructional

Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar under natural condition during *khariif*, 2017. Germplasms were sown in the field with two replications. Observation on disease intensity of anthracnose was recorded at ten days intervals after germination on the

basis of disease severity 1 to 9 scales (Sharma, 1983) [9]. Per cent disease intensity was calculated by following formula mentioned 2.1. Reaction of germplasm was categorized as below described by Kumari and Singh (2014) [3].

(A) Description of anthracnose rating scale 1-9 (Sharma, 1983) [9]

Score	Description
1	No symptoms or presence of chlorotic flasks
2	1-5 % leaf area covered with lesion
3	6-10 % leaf area covered with lesion
4	11-20 % leaf area covered with lesion
5	21-30% leaf area covered with lesion
6	31-40 % leaf area covered with lesion
7	31-50 % leaf area covered with lesion
8	51-75 % leaf area covered with lesion
9	> 75 % leaf area covered with lesion

(B) Anthracnose disease severity rating scale (Kumari and Singh, 2014) [3]

Sr. No.	Per cent intensity	Reaction
1	0 to < 1.0	Highly resistant
2	1.1- 5.0	Resistant
3	5.1-10.0	Resistant
4	10.1-20.0	Moderately Resistant
5	20.1-30.0	Moderately Resistant
6	30.1-40.0	Susceptible
7	40.1-50.0	Susceptible
8	50.1-75.0	Highly Susceptible
9	75.1 and above	Highly Susceptible

rainfall, high RH and warm temperature enhance the development and spread of the disease. Disease severity was increased with increased in the age of plant. Weather conditions, in particular rainfall play a critical role in the severity of sorghum anthracnose (Thakur and Mathur, 2000 and Chala *et al.*, 2010) [10].

3.1.2 Survey of anthracnose disease

The roving survey was conducted in three talukas of Banaskantha district in the second week of September during *Khariif*, 2017. Farmers of Dantiwada, Deesa and Palanpur talukas of Banaskantha district generally are growing Malvan and GJ-39 varieties of sorghum in the first to second week of July during *khariif* season. The survey revealed that anthracnose of sorghum was more in Dantiwada taluka. The highest disease intensity of anthracnose was observed in Nandotra village followed by Vaghrol village in Dantiwada taluka of Banaskantha district (Table -1).

3 Results and Discussion

3.1 Survey of anthracnose disease of sorghum in Banaskantha district

3.1.1 Disease occurrence

The disease usually occurs in mid-July to October. The naturally infected plants were observed under frequent

Table 1: Survey of anthracnose disease of sorghum in Banaskantha district

Sr. No.	Talukas	Villages	Anthracnose PDI (%)	Mean (%)
1	Dantiwada	Nandotra	60.37	56.29
		Sikariya	52.96	
		Vaghrol	55.56	
2	Deesa	Latiya	54.44	52.96
		Ranpur	51.11	
		Vasada	53.33	
3	Palanpur	Hebatpur	50.00	47.28
		Khemana	44.07	
		Songadh	47.78	

In Dantiwada taluka, highest per cent disease intensity (PDI) (60.37%) was recorded in Nandotra village followed by Vaghrol (55.56%) and least PDI in Sikariya (52.96 %). In Deesa taluka, highest per cent disease intensity (54.44 %) was recorded in Latiya village followed by Vasada (53.33 %) and least PDI in Ranpur (51.11%). In Palanpur taluka, highest per cent disease intensity (50.00%) was in Hebatpur village followed by Songadh (47.78%) and least PDI was recorded in Khemana (44.07%). Mean disease intensity of anthracnose was highest in Dantiwada taluka (56.29%) followed by Deesa taluka (52.96%) and least disease intensity was observed in Palanpur taluka (47.28%) of Banaskantha district.

3.1 Screening of sorghum germplasms against anthracnose disease

The use of resistant varieties provides the most effective method of managing the disease. Fifty sorghum germplasms were screened under field conditions against anthracnose disease during *khariif*, 2017. The observation was recorded at 25 days after sowing and then after 10 days interval up to harvesting. Among them, seven germplasms showed resistant reaction [FM-303, 1013-4 (C-43 × UPMC-512), EJM-26, EJM-203, ER-23, ER-25 and CSV-17 × SPV-2133], 16 germplasms were moderately resistant (SRF-305 (1079), EC-842912, EC-289489, EC-485031, HC-308, SRF-305 (1096)

etc., 21 germplasms were susceptible (EC-487508, EC-487541, EC-487837, EC-487509, DS-1178, DS-1181, DS-1161, DS-1165, DS-1162) etc. and six germplasms were

showed highly susceptible (EC-487502, EC-487507, EC-487495, EC-487347, EC-483112 and DS-1165) reaction against anthracnose disease (Table -2 and 3).

Table 2: Screening of sorghum germplasms against anthracnose disease in field conditions

Sr. No.	Name of germplasm	Days After Sowing							
		25	35	45	55	65	75	85	95
1	EC-487508	22.22	27.78	33.33	37.78	42.22	44.44	45.56	48.89
2	EC-487502	25.56	27.78	36.67	52.22	67.78	70.00	73.33	76.67
3	EC-487541	24.44	28.89	31.11	33.33	36.67	41.11	44.44	46.67
4	EC-487507	25.56	33.33	45.56	54.44	63.33	61.11	64.44	72.22
5	EC-487495	27.78	33.33	44.44	58.89	70.00	72.22	74.44	75.56
6	EC-487347	31.11	42.22	52.22	58.89	67.78	74.44	78.89	80.00
7	EC-487837	20.00	26.67	28.89	33.33	37.78	42.22	45.56	50.00
8	EC-487509	23.33	28.89	34.44	37.78	40.00	43.33	46.67	47.78
9	DS-1178	20.00	24.40	30.00	33.33	37.78	40.00	42.22	44.44
10	DS-1181	22.22	27.78	34.44	38.89	41.11	43.33	46.67	47.78
11	DS-1161	24.44	28.89	31.11	34.44	38.89	40.00	41.11	43.33
12	DS-1165	24.44	28.89	38.89	53.33	58.89	60.00	67.78	70.00
13	DS-1162	26.67	30.00	34.44	36.67	38.89	42.22	44.44	45.56
14	SRF-305 (1079)	10.00	13.33	13.33	16.67	16.67	17.78	18.89	20.00
15	FM-303	6.67	7.78	7.78	8.89	8.89	10.00	10.00	10.00
16	1013-4 (C-43 × UPMC-512)	6.67	6.67	7.78	7.78	7.78	8.89	8.89	8.89
17	1030-5(UPMC-503 × SFRIL-75)	23.33	25.56	32.22	36.67	40.00	43.33	45.56	48.89
18	1030-4	20.00	24.44	28.89	33.33	36.67	38.89	40.00	41.11
19	1030-5 (C-43 × UPMC-512)	12.22	13.33	13.33	15.56	16.67	17.78	18.89	21.11
20	1013-4	22.22	25.56	30.00	32.22	37.78	40.00	41.11	43.33
21	EC-483990	22.22	25.56	28.89	30.00	33.33	36.67	38.89	40.00
22	EC-483436	24.44	26.67	31.11	34.44	37.78	38.89	40.00	42.22
23	EC-842912	13.33	15.56	16.67	16.67	17.78	18.89	20.00	22.22
24	EC-843004	23.33	28.89	31.11	34.44	37.78	40.00	43.33	45.56
25	EC-485202	24.44	26.67	30.00	33.33	36.67	38.89	41.11	44.44
26	EC-289768	25.56	28.89	31.33	36.67	40.00	42.22	44.44	47.78
27	EC-483112	26.67	41.11	48.89	54.44	61.11	67.78	71.11	74.44
28	EC-289489	24.44	26.67	32.22	34.44	37.78	40.00	43.33	46.67
29	EC-485031	11.11	13.33	15.56	16.67	18.89	20.00	21.11	21.11
30	EC-488239	22.22	25.56	28.89	33.33	38.89	41.11	44.44	48.89
31	EJN-203	20.00	24.44	26.67	30.00	33.00	36.67	38.89	40.00
32	EJN-26	6.67	6.67	7.78	7.78	8.89	8.89	8.89	10.00
33	FM-624	7.78	7.78	7.78	8.89	8.89	8.89	10.00	10.00
34	HC-308	8.89	10.00	11.11	12.22	13.33	15.56	16.67	17.78
35	FM-238	23.33	27.78	34.44	38.89	41.11	42.22	45.56	50.00
36	SRF-305(1096)	12.22	15.67	16.67	17.78	20.00	21.11	23.33	24.44
37	ER-23	6.67	6.67	6.67	7.78	7.78	7.78	8.89	8.89
38	FM-363	24.44	28.89	33.33	36.67	40.00	41.11	44.44	47.78
39	ER-25	6.67	6.67	7.78	7.78	7.78	8.89	8.89	8.89
40	09-132(UPMC-503 × AKR-150)	11.11	12.22	15.56	18.89	21.11	23.33	24.56	25.56
41	CSV-27 × SPV-2109-7	15.56	16.67	18.89	18.89	20.00	20.00	22.22	23.33
42	CSV-27 × SPV-2109-16	13.33	14.44	16.67	18.89	20.00	21.11	23.33	24.44
43	CSV-17 × SPV-2133	6.67	7.78	7.78	8.89	8.89	10.00	10.00	10.00
44	SPV-2110 × GFS-5	14.44	14.44	17.78	18.89	20.00	22.22	24.44	26.67
45	SPV-2110 × GJ-39	15.56	16.67	18.89	18.89	20.00	20.00	22.22	24.44
46	SPV-2113 × GJ-39	14.44	15.56	16.67	18.89	20.00	21.11	22.22	23.33
47	SPV-2113 × SSV-84	15.56	16.67	18.89	22.22	22.22	24.44	25.56	27.78
48	SPV-2113 × GFS-5	15.56	15.56	17.78	18.89	20.00	21.11	23.33	25.56
49	2501(AKR-354 × RS-627)	13.33	15.56	18.89	20.00	21.11	22.22	24.44	26.67
50	2571(NSSB-15 × NSSB-1005)	14.44	16.67	17.78	18.89	20.00	22.22	24.44	27.78
Check	Malvan	29.09	35.76	41.61	48.28	55.25	60.40	66.16	71.11

Table 3: Reaction of sorghum germplasms against anthracnose disease in field conditions

Sr. No.	Disease Reaction	Number of germplasms	Name of Germplasm
1	Resistant	7	FM-303, 1013-4 (C-43 × UPMC-512), EJM-26, FM-624, ER-23, ER-25, CSV-17 × SPV-2133
2	Moderately resistant	16	SRF-305 (1079), EC-842912, EC-485031, HC-308, SRF-305(1096), 1013-4, 09-132 (UPMC-503 × AKR-150), CSV-27 × SPV-2109-7, CSV-27 × SPV-2109-16, SPV-2110 × GFS-5, SPV-2110 × GJ-39, SPV-2113 × GJ-39, SPV-2113 × SSV-84, SPV-2113 × GFS-5, 2501(AKR-354 × RS-627), 2571(NSSB-15 × NSSB-1005)
3	Susceptible	21	EC-487508, EC-487541, EC-487837, EC-487509, DS-1178, DS-1181, DS-1161, DS-1162, 1030-5(UPMC-503 × SFRIL-75), 1030-5 (C-43 × UPMC-512), 1030-4, EC-483990, EC-483436, EC-843004, EC-485202, EC-289768, EC-289489, EC-488239, EJM-203, FM-238, FM-363
4	Highly susceptible	6	EC-487502, EC-487507, EC-487495, EC-487347, DS-1165, EC-483112

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