



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(7): 1940-1949
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www.thepharmajournal.com

Received: 09-05-2023

Accepted: 13-06-2023

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Identification of resistant sources of wheat against spot blotch (*Bipolaris sorokiniana*) disease

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Abstract

Creating resistant agricultural disease-resistant cultivars is the most efficient way to control crop diseases. At the MES farm of the Acharya Narendra Deva University in Kumarganj, Ayodhya, Uttar Pradesh, 218 wheat genotypes were tested for resistance to spot blotch (*Bipolaris sorokiniana*) under natural epiphytotic circumstances on dates (15 December and 28 November) in 2021 and 2022. The Raj 4015 and Agra local wheat genotypes were used as a susceptibility check in the experiment's modified design. For both growing seasons, disease scoring was performed three times, seven days apart. The area under the Disease Progressive Curve (AUDPC) and disease severity were computed. Disease severity and AUDPC levels differed considerably between the genotypes examined for both growth seasons. A review of the data revealed that, of the 218 genotypes examined, none were determined to be immune (score 00-01). (Score 12–24) No genotypes were shown to be resistant. Ninety-four genotypes were discovered to be just moderately resistant to spot blotch. There are four genotypes pes susceptible spot blotch and 120 moderately susceptible individuals. This shows that regardless of the genotypes of wheat farmeseeding-resistant varieties of wheat are beneficial for lowering yield loss due to spot blotch disease.

Keywords: Screening, AUDPC, Evolution, spot blotch, scoring, wheat

Introduction

Wheat is one of the most widely produced and consumed grains in the world is wheat. It provides 20% of the world's population's total calories and protein (Poudel and Bhatta, 2017) [6]. For a sizable portion of the world's population, wheat (*Triticum aestivum* L.) serves as their main source of nutrition. The crop comes in second place to rice in terms of overall output in India. In this highly populated area of the world, it is crucial to guarantee food security. 13 percent of the world's total wheat crop is produced in India. According to Kronstad (1998) [1], by 2020, the world's population would require around 1,050 million tonnes of wheat, while India's demand will be between 105 and 109 million tonnes (Shoran *et al.*, 2005) [2]. This means that the demand for wheat will increase more quickly than that for any other major crop. *Cochliobolus sativus* (Ito and Kurib.) Drechsler ex Dastur [anamorph: *Bipolaris sorokiniana* (Sacc.) Shoem causes spot blotch, which is the most significant constraint for the production of wheat and leads in a significant yield loss (Joshi *et al.*, 2007) [3]. Crop rotation, chemical management, controlling planting timing, and the adoption of resistant varieties are all effective ways to manage B. sorokiniana. Researchers have worked extremely hard to uncover and create genetic resources for spot blotch resistance since genetic resistance is one of the most effective ways to prevent illness (Singh *et al.*, 2006) [7].

Methods Materials

Evaluation of wheat genotypes for disease resistance

The experiment was conducted at the Acharya Narendra Deva University of Agriculture and Technology's Main Experimental Station in Kumarganj, Ayodhya (U.P.) between Rabi 2021–22 and 2022–23. Seeds from 218 genotypes of the All India Co-ordinated Wheat and Barley Improvement Project were collected and sent to the Department of Genetics and Plant Breeding at the Acharya Narendra Deva University of Agriculture and Technology in Kumarganj, Ayodhya (U.P.). Two rows of border rows were planted with Raj 4015 and Agra local, a plant vulnerable to foliar blight, throughout the whole perimeter of the experiment. The seed was also sown every 20 entries. All recommended agronomic and cultural techniques were employed to yield the high-quality crop. The details of the experiments are as follows:

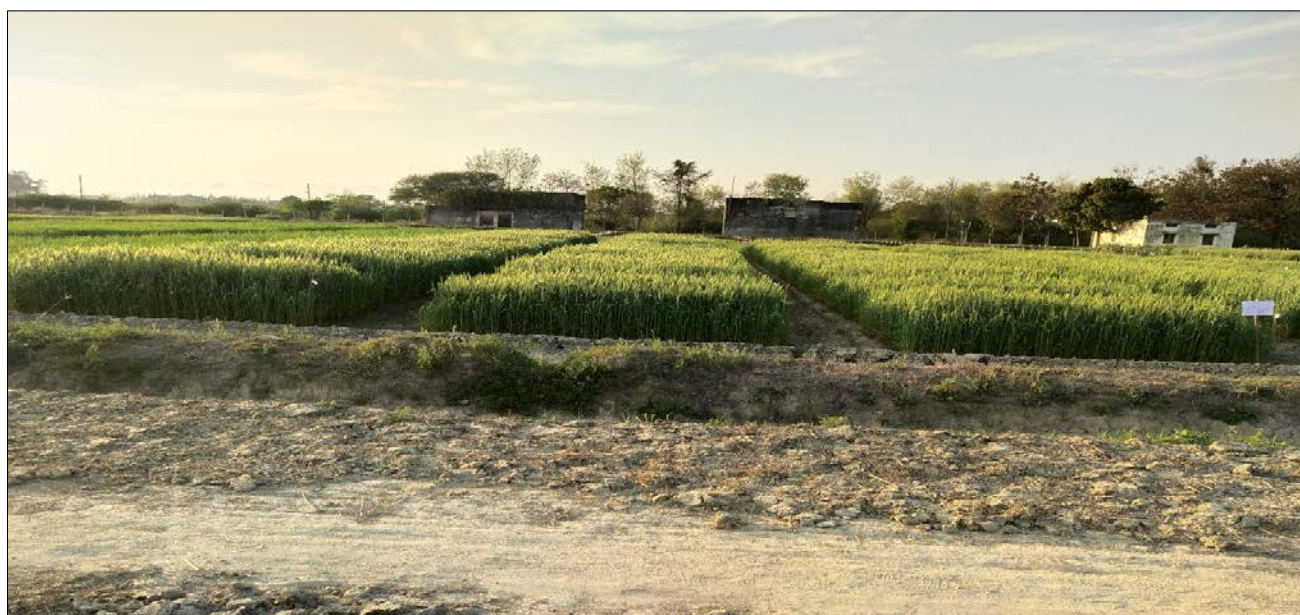


Photo 1: Screening Trail at MES Farm

No. of genotypes: 218

Design: Augmented

Plot size: One row of one-meter length

Spacing: 20 cm (row to row)

Plant to plant: 5 cm

Fertilizer: 120:60:40 N: P: K (kg/ha)

Sowing date: 15/12/2021 and 28/11/2022

A list of genotypes screened in this trial have been given in Table No. 1.

Table 1: List of wheat genotypes evaluated against spot blotch disease 2021-2022 & 2022-23

Entry No.	Genotype	Entry No.	Genotype	Entry No.	Genotype
1	AKDW-5348	33	SKW-375	65	VW 2109
2	AKAW-5440	34	SKW-376	66	VW 2111
3	AKDW-5442	35	SKUA-WW-101	67	VW 2113
4	AKAW-5446	36	SKUA-WW-102	68	VW 2115
5	AKAW-5447	37	SKUA-WW-103	69	VW 2117
6	AKAW-5448	38	SKUA-WW-104	70	VW 2118
7	AKAW-5449	39	SKUA-WW-105	71	VW 2120
8	AKAW-5512	40	SHUATS-W58	72	VW 2121
9	AKAW-5514	41	SHUATS-W63	73	Infector
10	AKDW-5516	42	SHUATS-W86	74	VW 2123
11	AKAW-5517	43	SHUATS-W69	75	VW 2127
12	WSM-131-2-1	44	SHUATS-W74	76	VW 2128
13	WSM-138	45	Lok-2021-1	77	VW 2131
14	JKW 300	46	Lok-2021-2	78	VW 2132
15	JKW 301	47	Lok-2021-3	79	VW 2134
16	JKW 302	48	Lok-2021-4	80	VW 2138
17	JKW 303	49	Lok-2021-5	81	VW 2141
18	JKW 304	50	DSS-15-1737	82	VW 2143
19	JKW 305	51	DSS-16-1762-1	83	VW 2144
20	JKW 306	52	Infector	84	VW 2145
21	JKW 307	53	DSS-16-1766-1	85	VW 2146
22	JKW 308	54	DSS-16-1792-1	86	VW 2147
23	JKW 309	55	DSS-16-1826-1	87	VW 2149
24	SKW-367	56	RAUW 107	88	P 13820
25	SKW-368	57	RAUW 108	89	P13841
26	SKW-369	58	RAUW 109	90	P13851
27	SKW-370	59	RAUW 110	91	P13854
28	SKW-371	60	RAUW 111	92	P13855
29	SKW-372	61	RAUW 112	93	P14161
30	SKW-373	62	VW 2102	94	Infector
31	Infector	63	VW 2106	95	P13819
32	SKW-374	64	VW 2107	96	P13653
97	P13935	134	P 13839	171	VD 2020-7
98	P13978	135	P 13974	172	VD 2020-12

99	P13983	136	Infector	173	VD 2020-14
100	P13987	137	P 14271	174	VD 2020-1
101	P13989	138	P 14272	175	VD 2020-11
102	P13861	139	P9004	176	VD 2020-9
103	P14029	140	P9010	177	VD 2020-2
104	P13741	141	VA 2020-16	178	Infector
105	P13679	142	VA 2018-01	179	VD 2020-8
106	P14283	143	VA 2020-02	180	DR-19-47
107	P14284	144	VA 2020-19	181	DR-19-53
108	P14285	145	VA 2020-06	182	DR-20-08
109	P14286	146	VA 2020-17	183	UBKV-2021-1
110	P14287	147	VA 2020-18	184	UBKV-2021-2
111	P14288	148	VA 2020-13	185	UBKV-2021-3
112	P14291	149	VA 2020-14	186	UBKV-2021-4
113	P14292	150	VA 2020-11	187	UBKV-2021-5
114	P14123	151	VA 2020-08	188	BCW 26
115	Infector	152	VA 2020-10	189	BCW 27
116	P14124	153	VA 2020-15	190	BCW 28
117	P14126	154	VA 2020-34	191	BCW 29
118	P14154	155	VA 2020-35	192	BCW 30
119	P 13634	156	VA 2020-04	193	PW 2101
120	P 13833	157	Infector	194	PW 2102
121	P 13909	158	VA 2020-28	195	PW 2103
122	P 14091	159	VA 2020-26	196	PW 2104
123	P 14092	160	VA 2020-24	197	PW 2105
124	P 14100	161	VA 2020-32	198	PW 2106
125	P 14230	162	VA 2020-25	199	Infector
126	P 14232	163	VA 2020-30	200	PW 2107
127	P 14234	164	VA 2020-31	201	PW 2108
128	P 14235	165	VA 2020-33	202	PW 2109
129	P 14239	166	VA 2020-21	203	PW 2110
130	P 14240	167	VD 2020-3	204	PW 2111
131	P 12368	168	VD 2020-4	205	PW 2112
132	P 13787	169	VD 2020-5	206	PW 2113
133	P 13793	170	VD 2020-6	207	PW 2114
208	PW 2115				
209	PW 2116				
210	DW 281				
211	DW 284				
212	DW 288				
213	DW 289				
214	DW 290				
215	CG2101				
216	CG2102				
217	CG2103				
218	CG2104				

Observations recorded

Disease severity after Based on the percentage of blighted areas on the flag and flag-1 Leaf at the blooming, soft dough,

and hard dough phases, Kumar *et al.* (1998) ^[1] developed a double-digit scale. Each chosen plant's disease score was twice recorded.

The double-digit scale, based on per cent blighted area on the flag leaf and one leaf just below given by Kumar *et al.* (1998) ^[1].

A double-digit* scale for appraising blight severity				
Sr. No.	Severity**		Rating	
	Flag leaf	Flag-1 leaf	Disease response	Range of value
1.	0	0-1	Immune (I)	00-01
2.	1-2	2-4	Resistant (R)	12-24
3.	3-4	4-6	Moderately Resistant (MR)	34-46
4.	5-6	6-8	Moderately susceptible (MS)	56-68
5.	7-8	8-9	Susceptible (S)	78-89
6.	9	9	Highly susceptible (HS)	99

* First and second value respectively, represents per cent blighted area on the flag leaf and flag-1 leaves.

** Values 1, 2, 3, 4, 5, 6, 7, 8 and 9 respectively correspond to 10, 20, 30,40, 50, 60, 70, 80 and 90 per cent blighted areas.

Spot blotches during the dough stage were counted using a double-digit, 0-9 scale. The leaf under the flag leaf and the leaf above it were used to grade the disease's prevalence. The flag leaf's score is provided by the first of two digits, while the following (flag-1) leaf's score is provided by the second digit. The disease severity was calculated as a percentage of leaf area damaged at the dough stage using the Directorate of Wheat Research (DWR), Karnal, double-digit score. An average answer was calculated by subtracting the means of the two digits separately. The percent disease index (PDI) was calculated using the formula shown below:

$$\text{PDI} = \frac{\text{Sum of all numerical ratings}}{\text{Total number of plants} \times \text{maximum grade}} \times 100$$

In each plot 10 randomly selected plants were scored.

Result and Discussion

Since the use of resistant varieties is considered to be the method for disease management, therefore, the studies were carried out for the search of source of resistance against the spot blotch of wheat caused by *Bipolaris sorokiniana*. A total number of 218 genotypes of wheat were screened against *Bipolaris sorokiniana* under artificial epiphytotic conditions (Fig 9 & 10). Results of varietal screening have been presented in Tables No. 2 and 3. A perusal of data showed that out of two hundred eighteen genotypes tested, none genotypes have been found immune (score 00-01). None genotypes were found resistant (score 12-24). Ninety-four genotypes were found moderately resistant against spot blotch. Some of these were AKDW-5348, AKAW-5440, AKAW 5512, AKAW-5514, AKAW-5517, JKW 301, JKW 302, JKW 303, JKW 304, JKW 308, SKW-367, SKW-369, SKW-373, SKW-375, SKW-376, SHUATS-W63, Lok-2021-3, Lok-2021-4, DSS-15-1737, DSS-16-1766-1, DSS-16-1792-1, DSS-16-1826-1, RAUW 107, RAUW 108, RAUW 109, RAUW 110, RAUW 111, RAUW 112, VW 2102, VW 2106, VW 2109, VW 2115, VW 2117, VW 2123, VW 2128, VW 2132, VW 2134, VW 2138, VW 2141, VW 2143, VW 2144,

VW 2145, VW 2146, VW 2147, VW 2149, P 13820, P13841, P13851, P13854, P13855, P14161, P13819, P13653, P13935, P13978, P13983, P13987, P13989, P13861, P14029, P13679, P14283, P14284, P14286, P14287, P14288, P14291, P14292, P14124, P14126, P14154, P 13909, P 14092, P 14100, P 14230, P 14234, P 14235, P 14239, P 14240, P 12368, P 13787, P 13793, P 13839, P 13974, P 14271, P 14272, P9004, VA 2020-16, VA 2020-19, VA 2020-17, VA 2020-13, VA 2020-14, VA 2020-11, VA 2020-10, VA 2020-15, VA 2020-34, VA 2020-04, VA 2020-28, VA 2020-26, VA 2020-24, VA 2020-32, VA 2020-25, VA 2020-30, VA 2020-21, VD 2020-4, VD 2020-5, VD 2020-7, VD 2020-1, VD 2020-11, VD 2020-2, VD 2020-8, DR-19-47, DR-19-53, DR-20-08, UBKV-2021-2, UBKV-2021-3, UBKV-2021-4, UBKV-2021-5, BCW 26, BCW 27, BCW 29, PW 2102, PW 2103, PW 2105, PW 2106, PW 2108, PW 2109, PW 2110, PW 2112, PW 2113, PW 2114, PW 2115, PW 2116, DW 281, DW 284, DW 288, DW 290, CG2103. One hundred twenty genotypes were found moderately susceptible against spot blotch. Some of these were AKDW-5442, AKAW-5446, AKAW-5447, AKAW-5448, AKDW-5516, WSM-131-2-1, WSM-138, JKW 300, JKW 305, JKW 306, JKW 307, JKW 309, SKW-368, SKW-370, SKW-371, SKW-372, Infector, SKW-374, SKUA-WW-101, SKUA-WW-102, SKUA-WW-103, SKUA-WW-104, SKUA-WW-105, SHUATS-W58, SHUATS-W86, SHUATS-W69, SHUATS-W74, Lok-2021-1, Lok-2021-2, Lok-2021-5, DSS-16-1762-1, VW 2107, VW 2111, VW 2113, VW 2118, VW 2120, VW 2121, Infector, VW 2127, VW 2131, Infector, P13741, P14285, Infector, P14123, P 13634, P 13833, P 14091, P 14232, Infector, VA 2018-01, VA 2020-02, VA 2020-06, VA 2020-18, VA 2020-08, VA 2020-35, Infector, VA 2020-31, VA 2020-33, VD 2020-3, VD 2020-6, VD 2020-12, VD 2020-14, VD 2020-9, Infector, UBKV-2021-1, BCW 28, BCW 30, PW 2101, PW 2104, PW 2107, PW 2111, DW 289, CG2101, CG2104. And four genotypes were found susceptible against spot blotch. Some of these were AKAW-5449, Infector, Infector, CG2102, Raj 4015, and Agra Local.



Photo 2: View of screening trail against spot blotch of wheat caused by *B. sorokiniana*



Photo 3: Symptoms of spot blotch disease on wheat leaves in a screening trial



Photo 4: Screening trail at MES Farm ANDUA & T Ayodhya

Table 2: Response of wheat genotypes against foliar blight (*Bipolaris sorokiniana*) under artificial disease pressure and their AUDPC Rate during 2021-22 & 2022-23

Entry No.	Genotype	Foliar blight score (0-9 DD)									AUDPC	
		2021-22				2022-23					2021-22	2022-23
		Date of the first appearance of spot blotch (the day after sowing)	Flowering stage	Soft Dough Stage	Hard Dough Stage	Date the of the first appearance of spot blotch (the day after sowing)	Flowering Stage	Soft Dough Stage	Hard Dough Stage	Reaction		
1	AKDW-5348	38	12	24	46	46	13	34	47	MR	371	448
2	AKAW-5440	40	02	25	46	41	01	24	45	MR	343	336
3	AKDW-5442	42	24	36	57	42	12	34	56	MS	535.5	476
4	AKAW-5446	41	12	35	57	44	23	45	58	MS	486.5	598.5
5	AKAW-5447	45	23	46	58	28	35	46	57	MS	605.5	644
6	AKAW-5448	44	35	46	68	35	12	45	67	MS	682.5	591.5
7	AKAW-5449	42	24	56	78	30	34	45	76	S	749	668.5

8	AKAW-5512	39	01	12	35	34	01	25	36	MR	210	304.5
9	AKAW-5514	43	12	34	46	38	12	36	47	MR	406	458.5
10	AKDW-5516	40	24	35	57	40	12	34	56	MS	528.5	476
11	AKAW-5517	35	12	24	46	46	12	35	46	MR	371	448
12	WSM-131-2-1	38	12	36	57	35	24	46	58	MS	493.5	609
13	WSM-138	42	24	35	57	42	01	24	56	MS	528.5	367.5
14	JKW 300	39	02	35	58	42	12	35	57	MS	455	486.5
15	JKW 301	46	01	23	35	39	12	24	36	MR	287	336
16	JKW 302	45	12	24	35	43	01	24	36	MR	332.5	297.5
17	JKW 303	46	23	35	46	40	23	36	48	MR	486.5	5005.5
18	JKW 304	41	02	24	35	35	12	34	36	MR	297.5	336
19	JKW 305	42	23	46	57	38	02	24	56	MS	602	371
20	JKW 306	44	24	36	68	42	23	45	66	MS	574	626.5
21	JKW 307	28	13	35	57	39	02	35	58	MS	490	455
22	JKW 308	35	01	24	47	46	23	36	47	MR	336	497
23	JKW 309	30	24	45	68	45	12	36	48	MR	637	458.5
24	SKW-367	34	12	25	46	38	24	36	48	MR	378	504
25	SKW-368	38	23	36	57	40	01	34	57	MS	532	441
26	SKW-369	40	02	24	46	42	23	36	47	MR	336	497
27	SKW-370	46	01	34	57	41	24	36	58	MS	441	539
28	SKW-371	35	12	35	57	45	02	35	58	MS	486.5	455
29	SKW-372	42	24	46	68	44	24	45	67	MS	644	633.5
30	SKW-373	45	02	24	46	46	13	24	46	MR	336	374.5
31	Infector	40	24	35	67	47	24	56	68	MS	563.5	714
32	SKW-374	47	12	34	58	34	01	24	57	MS	483	371
33	SKW-375	46	12	24	46	46	12	35	47	MR	371	451.5
34	SKW-376	37	02	35	47	44	01	34	46	MR	416.5	402.5
35	SKUA-WW-101	44	24	35	58	29	02	35	57	MS	532	451.5
36	SKUA-WW-102	39	24	46	57	44	24	36	57	MS	605.5	5355
37	SKUA-WW-103	45	13	25	57	46	12	35	58	MS	420	490
38	SKUA-WW-104	34	35	46	68	45	24	35	67	MS	682.5	563.5
39	SKUA-WW-105	47	24	36	57	45	24	45	57	MS	535.5	598.5
40	SHUATS-W58	40	12	35	58	28	12	35	58	MS	420	490
41	SHUATS-W63	29	01	24	46	46	12	24	46	MR	336	371
42	SHUATS-W86	29	24	35	58	35	24	36	57	MS	532	535.5
43	SHUATS-W69	36	24	45	57	37	02	34	56	MS	598.5	441
44	SHUATS-W74	34	12	36	57	30	23	45	56	MS	493.5	591.5
45	Lok-2021-1	28	24	46	68	44	24	35	67	MS	644	563.5
46	Lok-2021-2	46	35	57	68	39	24	36	67	MS	759.5	570.5
47	Lok-2021-3	35	12	25	46	45	12	24	46	MR	381.5	371
48	Lok-2021-4	37	01	12	35	47	13	24	36	MR	210	339.5
49	Lok-2021-5	30	24	35	58	35	25	46	58	MS	462	612.5
50	DSS-15-1737	44	13	24	46	45	13	25	47	MR	346.5	385
51	DSS-16-1762-1	39	25	46	58	40	23	35	57	MS	612.5	525
52	Infector	45	35	46	78	47	24	46	76	S	717.5	672
53	DSS-16-1766-1	47	01	12	35	46	12	24	36	MR	210	336
54	DSS-16-1792-1	35	24	35	58	37	25	46	57	MS	462	609
55	DSS-16-1826-1	46	13	25	46	44	24	35	46	MR	385	490
56	RAUW 107	44	02	35	46	39	23	34	45	MR	413	406
57	RAUW 108	44	23	35	46	45	12	24	46	MR	490	371
58	RAUW 109	46	01	24	36	34	14	25	37	MR	297.5	353.5
59	RAUW 110	47	12	25	46	35	02	24	46	MR	381.5	336
60	RAUW 111	34	02	24	35	37	12	24	36	MR	297.5	336
61	RAUW 112	46	12	24	46	30	24	35	47	MR	371	493.5
62	VW 2102	44	24	35	46	44	12	23	45	MR	490	360.5
63	VW 2106	29	01	23	35	39	01	23	35	MR	287	287
64	VW 2107	44	25	46	57	39	02	24	56	MS	609	371
65	VW 2109	46	02	24	46	45	23	35	47	MR	336	490
66	VW 2111	45	23	35	57	34	12	34	56	MS	525	476
67	VW 2113	45	24	46	58	47	23	45	56	MS	609	591.5
68	VW 2115	41	01	12	34	40	12	24	36	MR	206.5	336
69	VW 2117	39	02	24	35	31	14	25	36	MR	297.5	350
70	VW 2118	39	24	35	57	29	12	24	56	MS	528.5	406
71	VW 2120	40	12	24	46	35	24	35	48	MR	371	497
72	VW 2121	44	24	35	58	42	23	36	57	MS	532	532
73	Infector	46	25	46	67	39	35	46	68	MS	644	682.5
74	VW 2123	42	01	12	35	39	12	24	36	MR	210	336
75	VW 2127	40	24	46	58	42	24	35	57	MS	609	528.5
76	VW 2128	45	01	24	35	41	12	23	34	MR	294	287
77	VW 2131	39	24	36	57	43	24	36	57	MS	535.5	535.5
78	VW 2132	36	12	35	46	37	12	24	46	MR	448	371
79	VW 2134	40	01	24	35	41	14	25	36	MR	294	350
80	VW 2138	35	12	24	35	39	13	25	37	MR	332.5	350
81	VW 2141	34	23	35	47	39	24	35	46	MR	490	490

82	VW 2143	34	01	23	35	40	12	25	36	MR	287	343
83	VW 2144	40	01	24	35	44	01	25	36	MR	294	304.5
84	VW 2145	31	23	35	46	46	12	35	46	MR	490	448
85	VW 2146	29	12	24	46	42	12	25	46	MR	371	378
86	VW 2147	35	01	12	35	40	01	24	35	MR	210	294
87	VW 2149	42	12	23	46	45	24	35	47	MR	364	493.5
88	P 13820	39	02	24	35	39	13	25	37	MR	297.5	350
89	P13841	39	12	25	47	36	24	36	48	MR	381.5	504
90	P13851	42	01	24	35	40	12	25	37	MR	294	346.5
91	P13854	41	12	35	46	35	12	24	36	MR	448	336
92	P13855	43	02	35	46	34	13	25	37	MR	413	350
93	P14161	37	12	24	35	34	14	25	36	MR	332.5	350
94	Infector	31	23	54	65	40	23	45	67	MS	686	630
95	P13819	34	24	35	46	34	24	36	48	MR	490	504
96	P13653	42	12	25	46	44	12	35	46	MR	378	448
97	P13935	36	02	24	35	31	02	24	35	MR	297.5	297.5
98	P13978	36	12	24	45	35	24	35	46	MR	374.5	490
99	P13983	40	12	35	46	29	24	35	47	MR	448	493.5
100	P13987	34	24	35	46	44	25	36	48	MR	493.5	507.5
101	P13989	44	01	24	35	31	01	24	36	MR	294	297.5
102	P13861	44	12	24	35	31	14	26	37	MR	332.5	360.5
103	P14029	34	12	24	45	42	01	35	46	MR	374.5	409.5
104	P13741	35	24	35	58	39	25	36	57	MS	532	539
105	P13679	28	01	25	46	39	01	25	47	MR	339.5	304.5
106	P14283	42	02	24	35	42	24	35	37	MR	297.5	458.5
107	P14284	36	24	35	46	36	24	36	47	MR	493.5	504
108	P14285	41	24	46	57	34	25	47	58	MS	605.5	619.5
109	P14286	32	01	12	35	43	01	25	36	MR	210	304.5
110	P14287	35	12	25	46	28	24	35	47	MR	448	493.5
111	P14288	42	02	23	35	34	13	25	36	MR	290.5	346.5
112	P14291	47	13	25	46	39	02	35	47	MR	381.5	416.5
113	P14292	39	12	23	35	37	12	25	37	MR	325.5	346.5
114	P14123	39	24	35	57	34	02	35	56	MS	528.5	448
115	Infector	37	24	35	58	36	24	35	57	MS	532	528.5
116	P14124	42	12	23	35	40	12	24	36	MR	325.5	336
117	P14126	34	01	23	35	35	01	25	37	MR	287	308
118	P14154	36	23	35	46	43	14	36	48	MR	486.5	469
119	P 13634	41	35	46	58	42	24	34	56	MS	647.5	518
120	P 13833	40	34	46	68	36	34	46	67	MS	682.5	675.5
121	P 13909	35	12	25	47	41	02	25	46	MR	381.5	343
122	P 14091	29	24	35	58	32	24	36	57	MS	532	535.5
123	P 14092	42	12	24	35	35	12	25	36	MR	332.5	343
124	P 14100	31	02	35	47	42	23	34	48	MR	416.5	486.5
125	P 14230	35	13	35	47	47	24	34	46	MR	455	483
126	P 14232	31	12	35	58	39	24	36	57	MS	490	535.5
127	P 14234	34	01	23	35	39	01	24	36	MR	287	297.5
128	P 14235	41	12	24	35	37	12	23	34	MR	332.5	322
129	P 14239	35	02	25	46	42	24	36	48	MR	343	504
130	P 14240	30	24	35	47	40	24	34	45	MR	416.5	479.5
131	P 12368	42	01	23	35	35	12	24	36	MR	287	336
132	P 13787	36	12	35	47	29	24	36	48	MR	451.5	504
133	P 13793	34	01	12	35	42	01	24	36	MR	210	297.5
134	P 13839	43	12	23	35	31	02	25	37	MR	325.5	311.5
135	P 13974	28	12	35	47	35	12	23	45	MR	451.5	360.5
136	Infector	34	24	36	57	31	25	47	59	MS	535.5	623
137	P 14271	39	12	23	35	34	13	24	36	MR	325.5	339.5
138	P 14272	37	01	24	46	41	13	37	48	MR	332.5	472.5
139	P9004	34	02	23	35	35	02	25	36	MR	290.5	308
140	P9010	36	24	34	46	30	25	35	47	MR	483	497
141	VA 2020-16	40	01	13	35	42	01	12	34	MR	217	206.5
142	VA 2018-01	35	12	24	57	36	13	26	58	MS	409.5	430.5
143	VA 2020-02	43	23	46	58	34	23	46	58	MS	605.5	605.5
144	VA 2020-19	42	12	25	46	40	23	35	47	MR	378	490
145	VA 2020-06	39	23	35	57	42	01	25	56	MS	525	304.5
146	VA 2020-17	34	01	12	35	41	01	15	37	MR	210	238
147	VA 2020-18	28	24	35	56	45	12	35	58	MS	525	490
148	VA 2020-13	46	02	34	46	44	12	25	47	MR	406	381.5
149	VA 2020-14	34	23	35	47	42	12	35	46	MR	490	448
150	VA 2020-11	44	12	36	46	39	23	36	48	MR	455	500.5
151	VA 2020-08	41	24	35	57	43	24	45	56	MS	528.5	595
152	VA 2020-10	41	12	35	46	40	13	34	45	MR	448	441
153	VA 2020-15	42	01	24	36	35	01	25	37	MR	297.5	308
154	VA 2020-34	32	24	35	46	38	13	35	47	MR	490	455

155	VA 2020-35	35	24	35	57	42	24	35	58	MS	528.5	532
156	VA 2020-04	41	12	24	46	42	13	24	46	MR	371	374.5
157	Infector	36	34	56	68	39	25	46	67	MS	749	644
158	VA 2020-28	38	12	25	47	34	12	25	46	MR	381.5	378
159	VA 2020-26	40	13	35	47	28	13	24	46	MR	455	374.5
160	VA 2020-24	42	01	24	35	46	01	24	36	MR	294	297.5
161	VA 2020-32	41	12	24	35	34	12	23	34	MR	332.5	322
162	VA 2020-25	45	12	35	46	44	13	24	45	MR	448	371
163	VA 2020-30	44	12	24	57	41	13	25	46	MR	409.5	381.5
164	VA 2020-31	42	01	12	35	41	24	35	56	MS	210	455
165	VA 2020-33	39	01	24	57	42	25	36	58	MS	371	542.5
166	VA 2020-21	43	25	35	68	32	24	45	67	MS	570.5	633.5
167	VD 2020-3	40	24	35	58	35	12	25	57	MS	532	416.5
168	VD 2020-4	35	13	24	46	41	02	25	47	MR	374.5	346.5
169	VD 2020-5	38	02	25	47	36	12	24	48	MR	346.5	378
170	VD 2020-6	42	24	35	57	38	12	36	58	MS	528.5	497
171	VD 2020-7	39	13	24	46	46	12	25	47	MR	374.5	381.5
172	VD 2020-12	46	23	45	57	45	13	35	58	MS	595	493.5
173	VD 2020-14	45	12	35	58	46	24	46	57	MS	490	605.5
174	VD 2020-1	46	12	35	47	41	12	36	48	MR	451.5	462
175	VD 2020-11	41	12	25	46	42	13	35	47	MR	378	455
176	VD 2020-9	42	23	46	57	44	13	35	58	MS	602	493.5
177	VD 2020-2	44	01	12	35	28	02	24	36	MR	210	301
178	Infector	28	24	35	56	35	24	35	57	MS	525	528.5
179	VD 2020-8	35	12	34	46	30	24	36	47	MR	406	5005.5
180	DR-19-47	30	02	23	35	34	01	13	36	MR	290.5	220.5
181	DR-19-53	34	24	35	47	39	25	36	48	MR	493.5	507.5
182	DR-20-08	38	23	35	47	45	12	35	46	MR	490	448
183	UBKV-2021-1	40	12	24	58	47	24	46	57	MS	378	567
184	UBKV-2021-2	46	12	24	47	35	12	26	48	MR	374.5	392
185	UBKV-2021-3	35	01	23	35	46	12	25	36	MR	287	343
186	UBKV-2021-4	42	12	35	46	44	12	34	46	MR	448	441
187	UBKV-2021-5	45	01	24	35	39	02	14	36	MR	294	231
188	BCW 26	40	12	23	45	36	12	35	46	MR	360.5	448
189	BCW 27	47	12	35	46	40	12	23	45	MR	448	360.5
190	BCW 28	46	24	46	57	35	24	35	58	MS	605.5	532
191	BCW 29	37	01	35	46	34	13	36	47	MR	409.5	462
192	BCW 30	30	24	46	57	34	23	34	58	MS	605.5	521.5
193	PW 2101	44	23	35	58	40	23	34	57	MS	528.5	518
194	PW 2102	39	01	12	35	31	01	13	35	MR	210	217
195	PW 2103	45	12	25	47	36	01	35	46	MR	381.5	409.5
196	PW 2104	47	12	46	58	36	24	46	57	MS	567	605.5
197	PW 2105	35	01	12	35	40	02	24	36	MR	210	301
198	PW 2106	46	12	24	46	34	12	24	45	MR	371	367.5
199	Infector	44	12	35	67	44	25	37	78	MS	486.5	549.5
200	PW 2107	39	24	35	58	44	12	35	57	MS	462	486.5
201	PW 2108	36	01	24	46	34	12	23	46	MR	332.5	364
202	PW 2109	40	12	35	46	40	13	24	45	MR	448	371
203	PW 2110	35	01	13	35	34	01	13	36	MR	217	220.5
204	PW 2111	34	24	46	57	44	23	35	56	MS	605.5	521.5
205	PW 2112	34	13	25	46	42	12	24	47	MR	381.5	374.5
206	PW 2113	40	12	24	35	38	12	23	35	MR	332.5	325.5
207	PW 2114	31	23	35	46	40	13	26	48	MR	486.5	465.5
208	PW 2115	36	12	24	47	46	12	24	46	MR	374.5	371
209	PW 2116	36	24	35	46	35	12	25	47	MR	490	381.5
210	DW 281	40	01	12	35	42	01	14	36	MR	210	227.5
211	DW 284	34	02	34	47	45	12	25	45	MR	409.5	374.5
212	DW 288	44	12	24	46	40	12	24	47	MR	374.5	374.5
213	DW 289	44	24	35	57	47	24	45	56	MS	528.5	595
214	DW 290	34	12	23	35	46	01	13	36	MR	325.5	220.5
215	CG2101	40	24	46	57	37	23	45	56	MS	605.5	591.5
216	CG2102	34	35	56	77	30	35	46	78	MS	682.5	679
217	CG2103	44	12	35	46	44	12	25	47	MR	448	381.5
218	CG2104	42	12	35	57	39	25	37	58	MS	486.5	594.5

AreaThe areaer disease progress curve (AUDPC)

The AUDPC calculated for 218 wheat genotypes on the basis of plant disease intensity varied from 168.0 to 1022.0 first year and 168.0 to 899.5 second year showing the fast progress

of disease in all genotypes. It was observed that different wheat genotypes expressed varied types of disease response against *Bipolaris sorokiniana* under artificial epiphytotic conditions in the field.

Table 3: Categorization of wheat genotypes against the response of spot blotch disease under artificial disease pressure (2021-2022) (2022-23)

S. No.	Disease Reaction	Score	No. of Genotypes	Genotypes
1.	Immune (I)	00-01	Nil	Nil
2.	Resistant (R)	12-24	Nil	Nil
3.	Moderately Resistant (MR)	34-46	94	AKDW-5348, AKAW-5440, AKAW 5512, AKAW-5514, AKAW-5517, JKW 301, JKW 302, JKW 303, JKW 304, JKW 308, SKW-367, SKW-369, SKW-373, SKW-375, SKW-376, SHUATS-W63, Lok-2021-3, Lok-2021-4, DSS-15-1737, DSS-16-1766-1, DSS-16-1792-1, DSS-16-1826-1, RAUW 107, RAUW 108, RAUW 109, RAUW 110, RAUW 111, RAUW 112, VW 2102, VW 2106, VW 2109, VW 2115, VW 2117, VW 2123, VW 2128, VW 2132, VW 2134, VW 2138, VW 2141, VW 2143, VW 2144, VW 2145, VW 2146, VW 2147, VW 2149, P 13820, P13841, P13851, P13854, P13855, P14161, P13819, P13653, P13935, P13978, P13983, P13987, P13989, P13861, P14029, P13679, P14283, P14284, P14286, P14287, P14288, P14291, P14292, P14124, P14126, P14154, P 13909, P 14092, P 14100, P 14230, P 14234, P 14235, P 14239, P 14240, P 12368, P 13787, P 13793, P 13839, P 13974, P 14271, P 14272, P9004, VA 2020-16, VA 2020-19, VA 2020-17, VA 2020-13, VA 2020-14, VA 2020-11, VA 2020-10, VA 2020-15, VA 2020-34, VA 2020-04, VA 2020-28, VA 2020-26, VA 2020-24, VA 2020-32, VA 2020-25, VA 2020-30, VA 2020-21, VD 2020-4, VD 2020-5, VD 2020-7, VD 2020-1, VD 2020-11, VD 2020-2, VD 2020-8, DR-19-47, DR-19-53, DR-20-08, UBKV-2021-2, UBKV-2021-3, UBKV-2021-4, UBKV-2021-5, BCW 26, BCW 27, BCW 29, PW 2102, PW 2103, PW 2105, PW 2106, PW 2108, PW 2109, PW 2110, PW 2112, PW 2113, PW 2114, PW 2115, PW 2116, DW 281, DW 284, DW 288, DW 290, CG2103.
4.	Moderately Susceptible (MS)	56-68	120	AKDW-5442, AKAW-5446, AKAW-5447, AKAW-5448, AKDW-5516, WSM-131-2-1, WSM-138, JKW 300, JKW 305, JKW 306, JKW 307, JKW 309, SKW-368, SKW-370, SKW-371, SKW-372, Infector, SKW-374, SKUA-WW-101, SKUA-WW-102, SKUA-WW-103, SKUA-WW-104, SKUA-WW-105, SHUATS-W58, SHUATS-W86, SHUATS-W69, SHUATS-W74, Lok-2021-1, Lok-2021-2, Lok-2021-5, DSS-16-1762-1, VW 2107, VW 2111, VW 2113, VW 2118, VW 2120, VW 2121, Infector, VW 2127, VW 2131, Infector, P13741, P14285, Infector, P14123, P 13634, P 13833, P 14091, P 14232, Infector, VA 2018-01, VA 2020-02, VA 2020-06, VA 2020-18, VA 2020-08, VA 2020-35, Infector, VA 2020-31, VA 2020-33, VD 2020-3, VD 2020-6, VD 2020-12, VD 2020-14, VD 2020-9, Infector, UBKV-2021-1, BCW 28, BCW 30, PW 2101, PW 2104, PW 2107, PW 2111, DW 289, CG2101, CG2104.
5.	Susceptible (S)	78-89	4	AKAW-5449, Infector, Infector, CG2102, Agra local, Raj 4015
6.	Highly Susceptible (HS)	99	Nil	Nil

In a field, 218 different wheat genotypes were tested for the presence of *Bipolaris sorokiniana*. None of these genotypes (scoring 00-1) have been discovered to be immune. Ninety-four genotypes were discovered to be just somewhat moderately resistant to spot blotch. AKDW-5348, AKAW-5440, AKAW 5512, AKAW-5514, and AKAW-5517 were a few of them. 120 genotypes were found to be just somewhat moderately susceptible to spot blotch. Four genotypes were discovered to be found susceptible to spot blotch, including AKDW-5442, AKAW-5446, AKAW-5447, AKAW-5448, AKDW-5516, WSM-131-2-1, WSM-138, JKW 300, JKW 305, JKW 306, JKW 307, JKW 309, and SKW-368. These included the CG2102, Infector, AKAW-5449, Raj 4015, and Agra local.

The AUDPC calculated for 218 wheat genotypes on the basis of plant disease intensity varied from 168.0 to 1022.0 first year and 168.0 to 899.5 second year showing the fast progress of disease in all genotypes. It was observed that different wheat genotypes expressed varied types of disease response against *Bipolaris sorokiniana* under artificial epiphytotic conditions in the field.

Since the use of resistant varieties is considered to be the best method for disease management, therefore, the studies were

carried out for the search of source of resistance against the spot blotch of wheat caused by *Bipolaris sorokiniana*. A total number of 218 genotypes of wheat from the ICARDA center (International Centre for Agriculture Research in Dry Land Areas Aleppo, Syria), were screened against *Bipolaris sorokiniana* under natural epiphytotic conditions.

None genotypes have been found immune (Score 00-01). Ninety-four genotypes were found moderately resistant against spot blotch. Some of these were AKDW-5348, AKAW-5440, AKAW 5512, AKAW-5514, and AKAW-5517. One hundred twenty genotypes were found moderately susceptible against spot blotch. Some of these were AKDW-5442, AKAW-5446, AKAW-5447, AKAW-5448, AKDW-5516, WSM-131-2-1, WSM-138, JKW 300, JKW 305, JKW 306, JKW 307, JKW 309, SKW-368, and four genotypes were found susceptible against spot blotch. Some of these were AKAW-5449, Infector, Infector, CG2102, Raj 4015 and Agra local.

Singh *et al.*, (2002a) evaluated 325 genotypes against the spot blotch. Out of these 256 genotypes 3 genotypes namely, NW-2043, MACS-2942 and HUWL -99003 gave resistant reaction, while 75 showed moderately resistant reaction.

Were found susceptible against this disease. Several scientists

have reported variable responses of different wheat genotypes.

Iftikhar *et al.*, (2012) ^[4] screened 56 commercial wheat varieties against spot blotch resistance under controlled and field conditions. Out of 56 commercial varieties, 12 varieties showed moderate resistance (MR) reaction under *in vitro* and *in vivo* conditions and 2 varieties showed moderate resistance at 2 scales under both conditions. Thirty-two varieties showed moderate susceptible (MS) and susceptibility (S) under controlled conditions but had moderate resistance under field conditions, whereas, 9 varieties including Faisalabad-83, 85, Inqilab-91, Kaghan-93, Kirin- 95, Kohinoor- 83, MH-97, Rohtas-90 and Zarlashata showed moderate resistance under both controlled and field conditions at 1 scale level.

Ojha *et al.*, (2016) ^[5] evaluated of 100 screened entries 20 number of genotypes showed highly resistant or immunity to the disease, whereas 28 genotypes were resistant, 22 genotypes moderately resistant, and 15 moderately susceptible and 15 genotypes susceptible.

Acknowledgement

The thankful and acknowledge the financial and mental support from Collthe the edge of Agriculture, Department of Plant Pathology, through my Ph.D. Research laboratory and their equipment.

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