Article AR2023b

DOI: HTTPS://DOI.ORG/10.23910/IJBSM/2019.11.1.2023b

International Journal of Bio-resource and Stress Management

Crossref

February 2020

Print ISSN 0976-3988
Online ISSN 0976-4038

IJBSM 2020, 11(1):040-045

Research Article *Stress Management*

Screening of Germplasm Against Alternaria Leaf Spot in Niger (*Guizotia abbyssinica* (L.f.) Cass)

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Open Access

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Citation: Suvarna et al., 2020. Screening of Germplasm Against Alternaria Leaf Spot In Niger (*Guizotia abbyssinica* (L.f.) Cass). International Journal of Bio-resource and Stress Management 2019, 11(1):040-045. HTTPS://DOI.ORG/10.23910/IJBSM/2020.11.1.2023b

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Conflict of interests: The authors have declared that no conflict of interest exists.

Abstract

Niger (*Guizotia abbyssinica* (L.f.) cass) is a minor oilseed crop in India, cultivated on a marginal and sub-marginal lands, hilly areas, sloppy areas and around forest lands. It has tolerance to insect pests, diseases and attack of wild animals. In order to evaluate niger germplasm for *Alternaria* leaf spot disease, 200 lines were collected from Project Coordinating Unit, Jabalpur and were screened for disease resistance during *kharif* 2013 at College of Agriculture, UAS, Raichur. Each germplasm line was sown in a single line. The same were evaluated for seed yield and other ancillary characteristics viz., days to 50% flowering, days to maturity, plant height, number of primary branches, number of capitula and seed yield. Among 200 lines sown, 189 lines were germinated and evaluated for disease incidence during flowering time. The 0-5 scale was used to score the disease. 32 lines were found to be immune as these didn't showed any infection (i.e. 0% infection). The 100 lines were scored 1 by showing 1-10% disease incidence and are found to be resistant. The remaining germplasm (57) lines were scored 2 by showing 11-25% disease incidence and are moderately resistant. None of the genotypes were found to be susceptible. For confirmation, the disease scoring is in progress under epiphytotic condition. The genotypes with high yielding and less/no disease incidence were also identified. So collecting and evaluating germplasm for disease incidence will help in boosting the process of development of high yielding disease resistant varieties of niger.

Keywords: Niger, *Guizotia abyssinica*, Germplasm, *Alternaria* leaf spot, seed yield

1. Introduction

Niger is an important minor oilseed crop cultivated in India and constitutes about 3% of oilseed production. Niger seed contains 35 to 45% oil, 20% protein and 12% soluble sugars. Both seed and oil are edible with no anti nutrient character and consumed by rural and tribal people. It is grown in both marginal and sub marginal lands with negligible inputs under rainfed conditions (Ranganatha et al., 2009) with high degree of tolerance to insect pests, diseases and by grazing animals (Ranganatha et al., 2014). Niger, being an important oil seed crop is found to be affected by many pest and diseases which causes huge damage to the crop. Niger crop suffers from many fungal diseases like leaf blight, root rot, damping-off, rust, wilt, charcoal rot, powdery mildew, leaf spot, galls and bacterial diseases namely wilt, blight and spot diseases. Further, the

Article History

RECEIVED in 08th August 2019 RECEIVED in revised form 18th January 2020 ACCEPTED in final form 25th February 2020

accidental rain at flowering stage enhances the *Alternaria* and *Cercospora* leaf spot incidence and results in the poor seed set and seed yield. The yield losses was more due to *Cercospora* leaf spot and *Alternaria* leaf blight (Kansara and Sabalpara, 2015 and 2016: Sandipan et al., 2014a, 2014c and 2018). Hence, mapping the extent of disease severity in different niger growing areas would enable us to locate the hot spots of disease severity and to evolve appropriate disease management strategies to mitigate the loss caused by disease in the respective localities by the cultivation of resistant varieties with suitable chemical management practices (Jagtap et al., 2014, Kansara and Sabalpara, 2015 and 2016, Sandipan et al., 2014a). An effective programme of disease management including breeding for disease resistance, currently studies pertaining to the use of fungicides, botanicals in management of these diseases are highly emphasized (Rajpurohit et al., 2005; Rajpurohit, 2011, Gupta, 2017, and Gupta et al., 2018). But this management is not ecofriendly and safe. So there is a need to screen and develop the disease resistant varieties. Some of resistant varieties were identified (Hegde, 2005 and Rajpurohit et al., 2005 and Kansara, 2014), which helps in disease management and thereby increases the productivity. Cursory perusal of literature revealed that, research work on screening of germplasm against *Alternaria* leaf blight is limited. Hence, an effort was made to screen lines against *Alternaria* leaf blight (Table 1).

Table 1: *Alternaria* leaf spot disease scoring in niger

Grade	Per cent leaf area affected	Reaction
0	0	Immune
1	1-10	Resistant
2	11-25	Moderately resistant
3	26-50	Moderately susceptible
4	51-75	Susceptible
5	>75	Highly susceptible

2. Materials and Methods

A field experiment was conducted at College of Agriculture, Raichur, UAS, Raichur (North-Eastern dry zone (Zone-2) of Karnataka, 16° 15´N latitude and 77° 20´E longitude at an elevation of 389 meters above mean sea level) to identify the sources of resistance to leaf blight in niger. Totally 200 germplasm lines supplied by Project Coordinating Unit, AICRP on Sesame and Niger, Jabalpur were screened for resistance during *Kharif* 2013 under natural epiphytotic conditions.

Each test lines were sown in a single row of 4 m length with a spacing of 30×10 cm^2 with three replications in randomised block design. In each replication 10 plants were randomly selected and the intensity of leaf blight caused by *Alternaria* spp., was recorded after 30^{th} and 60^{th} day of planting by using 0-5 scale. Among 200 germplasm lines sown, 189 lines were germinated and used for evaluation. In addition to the disease screening, the data on days to 50% flowering, plant height (cm), number of primary branches per plant, number of capitula per plant and the seed yield was recorded. The main emphasis was given on the screening of germplasm against the disease and their yield parameter.

3. Results and Discussion

The data on morphological, seed yield and yield attributing traits was subjected to descriptive statistics analysis in SPSS 23 software. Highest plant height was recorded by the genotype JN 122 (165.5 cm) and lowest was by EC 158672 (33.5 cm). The number of primary branches per plant was less (4.0) in the genotypes, 5-1, NSS 5427, JGP 50, KOMKEMP, NSS 5433, JN 32, JN 28 and JN 142, but the branches number was more in the genotypes UNS 9. Highest number of capsules (165) was recorded by ONS 133 and lowest by JN 20 (17.2). The seed yield data ranged from 0.5 g to 34 g (Table 2). Among the genotypes, KEC 6 recorded maximum yield of 34 g followed by JN 144 (26.5 g), JN 132 (26 g), PHW 5004-2 (25.5 g), N 122 (21 g) and JN recorded 20 g. The remaining germplasm recorded the yield less than 20 g/line. Similarly Getinet and Wold (2006) characterised 241 niger germplasm collections from different parts of Ethiopia and evaluated. Sreedhar (2003) reported the variability studies in niger. Genetic variability studies was carried out in niger germplasm and studied the yield and yield attributing characters (Vinod and Rajani, 2016, Baghel et al., 2018 and Suvarna et al., 2019).

The most simple and effective and economical method in the management of disease is utilisation of resistant cultivars. Resistant cultivars conserve natural resources and reduce the cost, time and energy when compared to the other methods of disease management. In the present study, 198 germplasm lines were screened for their reaction to leaf blight disease. The disease reaction of different germplasm lines was recorded. The germplasm lines showed varied degrees of reaction for the disease. It was observed that the germplasm showed immune to moderately resistant reaction with disease score varying between 0 to 2 (Table 2). Hence, the germplasm lines screened were showed immune to moderately resistant and the results were in accordance with the results reported by AICRP centers of Niger for the same set of lines scored in their location. (Annonymous, 2013).

Among 189 evaluated lines, 32 lines namely KEC 6, JN-10, RCR 23, RCR 238, RCR 2090, RCR 328, cherol No.1 *etc*., were immune and scored 0 grade, whereas 100 lines showed resistant reaction with disease score of 1 grade (JN 144, JN 132, PHW 5004-2, N-122, JN 94, JN 21, JN 20, BMD 69 *etc*.). The remaining 57 germplasm lines (COMB 2, UNS 9, BMD 66, No.14-B, PCU 183, JN 107, JN 77, etc.) were moderately resistant and scored 2 grade by showing 11-25% disease incidence. None of the genotypes were susceptible. For further confirmation, the disease screening should be carried out under artificial epiphytotic conditions. The results were on accordance with the work carried out by the different centres of AICRP on Niger and they were also identified resistant

Table 2: Mean data of morphological and seed yield and yield attributing characters and disease scoring of niger germplasm during *kharif* 2013

Sl. No.	EN	PHH	PB	CP	SYSL	ALS	Sl. No.	EN	PHH	PB	CP	SYSL	ALS
1.	KEC 6	85.0	6.0	53.0	34.0	0	39.	GA 11	90.0	5.0	48.5	13.0	1
2.	RCR 23	96.0	5.5	61.5	19.0	0	40.	COM B-2	96.0	6.0	63.5	18.0	2
3.	RCR 238	68.0	5.5	54.5	10.0	0	41.	CH 11	57.5	5.0	43.5	7.0	0
4.	RCR 290	67.5	5.0	50.0	12.0	0	42.	AISI 2	96.0	6.0	66.5	10.5	1
5.	RCR 328	103.5	6.5	60.0	8.0	0	43.	CH 32	68.0	4.5	39.5	4.5	0
6.	RCR 328	70.0	5.0	42.5	8.5	0	44.	PHULE 3	59.5	4.5	29.0	5.0	1
7.	KEC 1	68.5	6.0	65.0	10.5	1	45.	KOMKEMP	67.0	4.0	28.0	3.5	1
8.	KEC 5	58.0	5.5	31.5	10.5	1	46.	RCR 18	63.0	6.0	43.0	11.0	1
9.	KEC 8	60.0	5.0	34.5	8.5	0	47.	IGP 14	96.0	5.0	57.0	7.0	1
10.	KEC 15	70.0	5.0	43.0	3.0	0	48.	Mutunay	102.5	5.5	60.5	6.0	1
11.	PCU 211	85.8	5.5	48.0	2.5	0	49.	BPB 1	61.0	5.5	53.5	5.0	2
12.	PCU 208	92.5	5.5	53.0	10.5	1	50.	GA 40	71.0	5.0	38.5	1.0	2
13.	PCU 206	73.5	6.0	47.5	4.0	0	51.	IGP 30	79.5	5.0	54.0	7.0	1
14.	PCU 204	68.0	5.5	47.5	0.5	1	52.	Goudagudu	85.0	5.0	53.0	6.0	1
15.	PCU 200	102.5	6.5	63.5	5.0	0	53.	PCU 188	61.0	5.0	53.0	8.0	1
16.	PCU 197	69.5	5.0	40.0	2.5	0	54.	IGP 11	69.0	5.0	42.0	6.0	1
17.	N 122	72.0	5.5	48.5	21.0	1	55.	GA 2	96.0	5.0	56.5	9.5	2
18.	PCU 196	80.5	6.0	57.5	9.5	1	56.	Phule 2	117.5	6.5	72.0	2.0	2
19.	PCU 194	69.0	6.0	42.5	5.0	0	57.	IGP 68	98.5	5.0	52.5	8.5	2
20.	KHN 1	84.0	5.0	47.5	4.5	1	58.	CH 2	96.0	5.5	60.5	8.0	1
21.	61-30	83.0	5.5	45.0	9.5	1	59.	DB 197	68.5	5.0	52.5	2.0	1
22.	5-64	56.5	6.0	40.5	3.0	0	60.	RCR 5-74	85.5	6.5	65.5	10.5	1
23.	5-1	51.5	4.0	24.0	8.5	0	61.	EC 158660	57.5	4.5	30.0	11.0	1
24.	5-4	51.5	5.5	30.5	12.0	0	62.	EC 158672	84.0	5.5	43.5	7.5	1
25.	89-25	60.5	5.0	40.0	8.0	0	63.	EC 158670	116.5	5.0	81.5	11.0	1
26.	18-64	45.0	5.0	29.0	5.0	0	64.	EC 158671	135.0	5.5	45.0	7.5	1
27.	5-70	57.5	4.5	40.0	3.0	0	65.	EC 158672	33.5	4.5	50.0	4.5	0
28.	PHW 5004-2	66.0	5.0	58.0	25.5	1	66.	EC 158673	58.0	4.5	33.0	3.0	1
29.	CH 7	67.0	6.0	45.0	9.5	0	67.	NC 63586	96.0	5.5	40.5	4.0	1
30.	Cherol No.1	64.5	5.5	46.5	10.0	0	68.	NC 62592	65.0	4.5	33.5	2.0	1
31.	PCU 191	70.0	5.5	41.0	1.5	1	69.	NC 63595	87.5	5.5	66.5	3.0	2
32.	NA 47	71.0	5.0	44.0	8.0	2	70.	NC 63597	93.0	5.0	44.5	4.0	1
33.	NA 47	63.0	4.5	53.0	7.5	0	71.	PCU 183	88.5	6.0	65.0	11.0	2
34.	NA 48	66.0	5.0	52.5	5.0	0	72.	PCU 182	69.5	5.0	34.5	5.0	1
35.	Phule 4	63.0	5.5	56.0	0.5	0	73.	PCU 181	69.0	5.0	39.5	4.0	2
36.	IGD 272	85.5	5.5	56.5	0.5	0	74.	CWA 1	95.0	6.0	49.0	5.0	2
37.	No. 1	53.5	6.0	55.5	9.5	0	75.	IGP 50	66.0	4.0	35.0	6.0	2
38.	No. 14-B	64.0	5.5	35.0	11.0	2	76.	PCU 180	74.5	4.5	48.5	4.0	1

EN: Entry name; PHH: Plant height at harvest (cm); PB: # of primary branches; CP: # of Capsules plant^{-1}; SYS: Seed yield single line^{-1} (g); ALS: Alternaria leaf spot

Table 2: Continue...

Sl. No.	EN	PHH	PB	CP	SYSL	ALS	Sl. No.	EN	PHH	PB	CP	SYSL	ALS
77.	PCU 179	82.0	6.0	46.5	5.0	1	116.	JN 69	97.6	6.2	53.2	1.5	2
78.	SVT 801	88.5	5.0	47.0	5.0	2	117.	JN 72	67.6	5.6	33.6	5.0	1
79.	JN 3	84.0	4.5	38.5	5.0	2	118.	JN 75	84.8	4.8	28.8	11.0	1
80.	JN 4	87.5	4.5	50.0	4.5	1	119.	JN 77	77.8	4.8	31.6	10.0	2
81.	JN 5	92.0	5.0	43.0	4.0	2	120.	JN 78	70.8	5.6	28.8	5.0	2
82.	JN 6	96.5	5.0	41.5	4.5	1	121.	JN 85	100.8	5.8	40.8	3.0	2
83.	JN 7	77.0	6.0	43.5	3.5	2	122.	JN 86	91.6	6.4	36.6	7.0	2
84.	JN 9	78.0	5.5	41.5	4.0	0	123.	JN 87	84.0	5.6	31.8	7.0	1
85.	JN 10	79.0	5.0	35.0	20.0	0	124.	JN 88	96.4	6.0	39.4	3.5	2
86.	JN 13	80.2	4.5	40.0	6.5	0	125.	JN 105	87.2	6.4	41.0	3.5	1
87.	JN 14	77.4	5.2	25.2	10.0	1	126.	JN 106	104.6	6.6	64.8	9.5	2
88.	JN 17	82.8	5.8	47.2	12.5	1	127.	JN 107	89.4	6.0	38.8	10.5	2
89.	JN 19	63.0	6.0	23.2	3.0	2	128.	JN 91	114.4	6.0	92.0	4.0	2
90.	JN 20	85.8	4.4	17.2	15.0	1	129.	JN 93	84.4	6.0	35.6	4.0	2
91.	JN 16	85.8	4.6	33.8	5.0	1	130.	JN 94	97.0	6.0	41.6	16.5	1
92.	JN 21	100.4	4.6	30.8	15.5	1	131.	JN 95	67.4	6.0	26.8	4.5	1
93.	JN 22	89.0	4.8	35.6	2.0	1	132.	JN 96	75.8	5.8	38.8	4.5	2
94.	JN 23	124.0	6.8	33.8	7.5	1	133.	JN 98	93.4	5.6	46.2	5.0	2
95.	JN 24	82.4	5.6	32.6	4.5	2	134.	JN 99	101.6	5.6	75.6	3.5	2
96.	JN 27	86.6	6.0	32.2	9.0	1	135.	JN 100	82.6	5.6	38.8	4.0	1
97.	JN 35	90.4	6.2	34.8	3.0	1	136.	JN 109	72.0	6.2	36.4	2.5	1
98.	JN 36	90.4	4.8	39.2	5.5	1	137.	JN 110	68.8	5.4	35.4	4.5	1
99.	JN 28	90.6	4.0	26.0	6.0	2	138.	JN 112	62.7	5.5	59.0	5.0	1
100.	JN 29	76.0	4.4	30.2	10.0	1	139.	JN 113	72.5	6.0	43.5	6.0	2
101.	JN 30	79.4	4.6	24.8	10.0	1	140.	JN 116	70.5	6.0	47.5	6.5	1
102.	JN 32	81.4	4.0	34.2	5.0	2	141.	JN 117	68.5	6.0	52.5	4.0	1
103.	JN 33	77.4	5.6	33.4	2.5	2	142.	JN 118	69.0	6.5	81.5	3.0	1
104.	JN 37	84.4	5.6	43.0	3.0	1	143.	JN 121	69.0	6.0	36.0	4.0	2
105.	JN 38	70.0	5.2	39.4	1.5	1	144.	JN 122	165.5	5.5	99.5	3.0	2
106.	JN 39	83.0	4.8	36.6	0.5	1	145.	JN 124	98.5	6.5	96.5	10.5	1
107.	JN 40	77.2	4.8	38.6	0.5	1	146.	JN 128	94.0	6.5	97.5	4.5	1
108.	JN 42	93.2	5.6	47.8	5.0	1	147.	JN 130	68.5	6.5	60.0	4.0	2
109.	JN 44	93.0	5.2	53.6	6.0	1	148.	JN 131	81.5	5.0	50.0	8.0	1
110.	JN 45	70.4	4.6	33.8	9.5	1	149.	JN 132	92.5	6.0	60.0	26.0	1
111.	JN 48	76.4	4.4	37.4	1.5	2	150.	JN 133	96.5	5.0	85.0	3.0	1
112.	JN 49	80.6	4.8	38.2	2.0	1	151.	JN 135	75.0	5.0	46.5	3.0	1
113.	JN 57	73.4	5.2	42.0	6.0	1	152.	JN 138	96.0	6.0	61.5	2.5	2
114.	JN 58	91.0	5.2	46.0	3.5	1	153.	JN 140	80.0	5.0	55.0	5.5	1
115.	JN 68	86.4	6.8	64.0	7.5	2	154.	JN 141	89.0	5.0	66.5	7.0	1

EN: Entry name; PHH: Plant height at harvest (cm); PB: # of primary branches; CP: # of Capsules plant^{-1}; SYS: Seed yield single line^{-1} (g); ALS: Alternaria leaf spot

Table 2: Continue...

Sl. No.	EN	PHH	PB	CP	SYSL	ALS	Sl. No.	EN	PHH	PB	CP	SYSL	ALS
155.	JN 142	118.5	4.0	81.0	13.0	1	176.	PCU 177	66.6	5.0	39.5	3.0	1
156.	JN 143	110.5	6.0	103.0	3.0	1	177.	NSS 5374	63.0	6.0	46.0	2.5	2
157.	JN 144	110.0	6.0	95.0	26.5	1	178.	NSS 5490	82.5	6.0	67.0	9.5	1
158.	JN 145	89.0	5.0	53.0	7.0	1	179.	NSS 5393	78.5	5.0	48.0	13.0	1
159.	JN 147	89.0	6.0	75.0	10.0	1	180.	BMD 64	55.0	4.5	38.5	9.0	1
160.	JN 146	76.5	5.5	53.0	3.0	1	181.	BMD 68	81.5	5.0	53.0	2.5	2
161.	ONS 107	81.5	5.5	70.5	2.0	2	182.	BMD 66	99.0	6.5	62.0	13.5	2
162.	ONS 109	89.0	5.5	59.5	7.0	1	183.	BMD 76	81.0	5.5	62.0	5.5	1
163.	ONS 130	82.0	5.5	63.5	12.5	1	184.	BMD 80	76.5	5.0	38.5	3.0	2
164.	ONS 133	135.0	6.0	165.0	2.0	1	185.	BMD 70	87.0	5.5	55.0	4.5	2
165.	ONS 135	96.5	6.0	71.5	6.5	1	186.	BMD 68	79.5	6.5	63.5	2.5	1
166.	ONS 136	89.0	5.5	61.5	3.0	2	187.	SP 127	99.0	6.0	52.0	5.5	2
167.	UNS 9	61.0	7.0	46.5	14.5	2	188.	BMD 71	91.5	6.0	50.0	3.0	2
168.	NSS 5479	62.0	5.5	50.5	2.0	2	189.	BMD 69	92.5	6.0	76.0	15.0	1
169.	NSS 5433	80.0	4.0	53.5	1.5	2	Mean		81.52	5.41	49.38	6.74	
170.	NSS 5437	92.0	6.0	41.5	3.0	2	Minimum		33.5	4	17.2	0.5	
171.	NSS 5439	89.0	5.0	58.0	4.0	2	Maximum		165.5	7	165	34	
172.	NSS 5427	60.0	4.0	35.0	4.0	1	Standard Error		1.25	0.05	1.29	0.37	
173.	NSS 5449	100.0	6.0	57.0	3.0	1	Standard Deviation		17.23	0.66	17.72	5.08	
174.	NSS 5442	60.0	5.5	44.5	3.5	1	Variance		296.89	0.43	314.10	25.81	
175.	PCU 178	102.5	6.0	72.5	2.5	2	C.V. (%)		21.14	12.15	35.89	75.42	

EN: Entry name; PHH: Plant height at harvest (cm); PB: # of primary branches; CP: # of Capsules plant^{-1}; SYS: Seed yield single line^{-1} (g); ALS: Alternaria leaf spot

lines against *Alternaria* leaf bight (Anonymous, 2011, and 2013). Sandipan et al. (2014) observed significant differences in resistance to all the diseases in the elite material tested under natural condition and the disease score of *Alternaria* and *Cercospora* varied between 1 to 3 grade, respectively. Some of resistant varieties were identified like JNC-6, 1GP-76, Deomali, GA-11, ONS-8 (Hegde, 2005 and Rajpurohit*et al*., 2005). Kansara (2014), screened 16 genotypes of niger against the leaf spot disease under natural condition, PCU-197 showed resistant reaction while 671/1, NB-76-14, 645/1, IGP-76, CWA-1, JLN-13, 233/1 and SVT-801 exhibited moderately resistant reaction. The six genotypes viz., NRS-96-1, NRS-99- 1, 207/1, IGPN-2004-1, RCR – 317, DHRN-1 and GN-1 exhibited moderately susceptible reaction against *Alternaria* blight of niger. The above results were also identical to findings of Prashant et al. (2014b), they screened 3 IVT and six AVT elite entries of niger against *Alternaria* blight diseases. Out of 19 elite materials, none were shown resistant reaction, where as IVT-13-7, IVT-13-8 and IVT-13-1 lines showed moderately resistant and all the AVT screened lines were moderately resistant to *Alternaria* blight of niger.

5. Conclusion

Niger is an important minor oilseed crop in Karnataka, India and cultivated as a mixed crop. Though it is tolerant to diseases, under favourable weather conditions disease may causes severe losses. Hence, there is a need to identify the resistant sources by screening of niger germplasm for location wise under hot spot conditions. In the present study, some of the genotypes *viz*., KEC-6, RCR 23, RCR 238, RCR 290, RCR 328, PCU 211, KEC 8, KEC 15, PCU 206, PCU 197, PCU 200, PCU 194, 5-70, 18-64, 89-25, 5-4, 5-1,5-64, CH 7, CHEROL No. 1, IGD 272, Phule 4, NA 48, NA 47, CH 11, CH 32, EC 158672, JN 9, JN 10 AND JN 13 recorded immune reaction and some genotypes *viz*., KEC 6, JN 144, JN 132, PHW 5004-2, N 122 and JN 10 showed resistant reaction with high yield. Hence, breeding for disease resistance needs the identifying the resistance source through screening and also helps in developing high yielding disease resistant genotypes against *Altenaria* blight.

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