



ISSN: 0976-3376

Available Online at <http://www.journalajst.com>

ASIAN JOURNAL OF
SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol. 5, Issue 8, pp. 491-496, August, 2014

RESEARCH ARTICLE

SOURCES OF RESISTANCE IN SCREENING OF ELITE MATERIAL IN NIGER (*GUIZOTIA ABYSSINICA* CASS) GENOTYPES AGAINST *ALTERNARIA* AND *CERCOSPORA* LEAF SPOT DISEASES UNDER NATURAL CONDITION

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ARTICLE INFO

Article History:

Received 24th May, 2014
Received in revised form
25th June, 2014
Accepted 02nd July, 2014
Published online 31st August, 2014

Key words:

Niger, *Alternaria*,
Cercospora, Diseases,
Resistance

ABSTRACT

A field experiment was laid out with the three replications in IVT, four replications in AVT and single row of three meters each of two hundred Germplasms was conducted at the All India Coordinated Research Project (AICRP) on oilseeds at Niger Research Station (NRS), Vanarasi, Navsari, Gujarat on the screening of different elite materials against the two major diseases of niger crop (*Guizotia abyssinica* Cass). Significantly differences in resistance to all the diseases were found in the elite material tested under natural condition. Results revealed that all the lines of IVT, AVT and germplasms the disease score of *Alternaria* and *Cercospora* may vary between 1.0 to 3.0 grade respectively. This study concludes that screening of elite lines of Niger for resistance to diseases is an important factor in developing varieties/hybrids with improved resistance to different diseases.

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INTRODUCTION

Niger (*Guizotia abyssinica* Cass) is one of the important minor oilseed crops of India. It is also known by various names such as Ramtil or Kalatil in India and Noog in Ethiopia. In India, it is mainly cultivated in tribal pockets of Gujarat, M.P., Orissa, Maharashtra, Bihar, Karnataka and Andhra Pradesh. Niger is a crop of dry areas grown mostly by tribal and interior places as life line of tribal segment. The Niger crop is found infested by number of diseases and pests, which causes harsh damage to the crop. Further, the accidental rain at flowering stage leads the expansion of *Alternaria* and *Cercospora* leaf spot incidence and results in the poor seed set and seed yield. The Niger seed contains 33.3 % protein, 34.2-39.7 % total carbohydrates and 13.5 % fiber. The crop is affected by number of fungal diseases. The important diseases of Niger are *Alternaria* blight (*Alternaria porii* and *A. alternata*), leaf spot (*Cercospora guizoticola*), Seedling blight (*Alternaria tenuis*), seed rot (*Rhizotonia bataticola*), rust (*Puccinia guizotiae*), powdery mildew (*Sphaetheca* sp.), root rot (*Macrophomina phaseolina*) and *Cuscuta* as *Phanerogamic* parasite (Rajpurohit, 2004, Bradley and Del Rio, 2007 and Rajpurohit and Dubal, 2009). *Cercospora* and *Alternaria* diseases cause heavy damage to this crop and reduce its seed yields, which harm the status of the farmers. Considering the economic losses in this present investigation attempts were therefore

made to ascertain the spectrum of fungal diseases of Niger crop. Seed is the costliest input and is highly prone to losses in germination and vigour due to seed mycoflora. Seeds act as carrier in transmission of pathogens and thereby cause economic threat to Niger cultivation. Considering the economic losses in this present investigation attempts were therefore made to ascertain this spectrum of fungal flora associated with the seeds of Niger elite materials.

MATERIALS AND METHODS

The seeds of elite material of Niger were received from Project Coordinator, Jabalpur, Madhya Pradesh. These elite lines were screened in the field under natural conditions for various diseases during *kharif* season of 2013 at AICRP on Niger Research Station (NRS), Vanarasi, Navsari, Gujarat. The screening of elite material against the major diseases was done in the three replications. Thirteen (13 + 1 Local check) entries of IVT, six (06 + 1 Local check) entries of AVT and two hundred entries of germplasms were screened in the field under natural condition during *kharif*, 2013. The test lines were sown in a randomized block design with the net plot size being single row of 3.0 m. Distance between rows was 30 cm and plant to plant distance was kept 10 cm. *Alternaria* susceptible genotype GN-1 were sown after every second row of test material, while in case of two hundred germplasm lines susceptible genotype GN-1 were sown after every fifth row of test material. Recommended agronomic practices and insect pest control measure were followed as per the standard

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package of practices (Anonymous, 2003). Further, the elite materials were categorized by taking the observation on foliar diseases, infection was calculated on Niger plant by observing top, middle and bottom leaves of the plant. Disease incidence was recorded by using Disease Rating scale of (0 to 5).

Score	Description	Reaction
0	No infection	Immune
1	1-10 % lead area infected	Resistant
2	11-25 % lead area infected	Moderately Resistant
3	26-50 % lead area infected	Moderately Susceptible
4	51-70 % lead area infected	Susceptible
5	71-100 % lead area infected	Highly Susceptible

The average intensity of each line was worked out by using following formula.

$$PDI = \frac{\text{Sum of observed numerical rating}}{\text{No. of leaves observed} \times \text{Max. Disease score}} \times 100$$

RESULTS AND DISCUSSION

Unremitting efforts to locate resistant sources and their utilization in resistance breeding programme are imperative to manage the diseases in the long run. Screening was therefore undertaken to evaluate a large number of elite line collections against major diseases of Niger crop during *kharif* 2013. The lines were evaluated based on 0 to 5 disease rating scale. The reaction of IVT and AVT lines and Germplasm lines is presented. There is significant differences and variations were observed in disease score (0 to 5 grade) for major diseases of Niger crop were observed in various lines. Thirteen IVT entries including one check were screened during the *kharif*, 2013. *Alternaria* and *Cercospora* leaf spot were the major diseases during the season. Incidence of *Alternaria* and *Cercospora* leaf spot varied from 2.0 to 4.0 grade and 1.0 to 2.0 grade respectively (Table No. 1 and 2).

Table 1. For, *Alternaria* leaf spot disease

Sr. No.	Treatment	Replication			Maximum Incidence (Score)	
		I	II	III	Test Culture	Control
*	GN-1 (SC)	3.0	3.5	3.5	-	3.3
1	IVT-13-1	2.5	2.5	2.5	2.5	-
2	IVT-13-2	2.5	2.5	3.5	2.8	-
*	GN-1 (SC)	3.5	3.5	3.0	-	3.3
3	IVT-13-3	3.5	2.5	2.5	2.8	-
4	IVT-13-4	2.5	3.0	3.0	2.8	-
*	GN-1 (SC)	4.5	4.0	3.5	-	4.3
5	IVT-13-5	3.0	3.5	3.0	3.1	-
6	IVT-13-6	3.0	2.5	4.0	3.1	-
*	GN-1 (SC)	3.5	3.5	4.5	-	3.8
7	IVT-13-7	2.5	2.0	3.0	2.5	-
8	IVT-13-8	2.5	2.5	2.5	2.5	-
*	GN-1 (SC)	4.0	3.5	3.5	-	3.6
9	IVT-13-9	2.5	2.5	3.5	2.8	-
10	IVT-13-10	3.0	2.5	3.0	2.8	-
*	GN-1 (SC)	4.0	4.0	4.5	-	4.1
11	IVT-13-11	3.0	3.0	3.5	3.1	-
12	IVT-13-12	2.5	2.5	3.0	2.6	-
*	GN-1 (SC)	4.0	3.5	4.0	-	3.8
13	IVT-13-13	2.5	2.5	3.0	2.6	-
*	GN-1 (SC)	3.5	3.5	4.0	-	3.6

Table 2. For, *Cercospora* leaf spot disease

Sr. No.	Treatment	Replication			Maximum Incidence (Score)	
		I	II	III	Test Culture	Control
*	GN-1 (SC)	3.0	3.0	2.5	-	2.8
1	IVT-13-1	1.5	2.0	1.5	1.6	-
2	IVT-13-2	1.5	1.5	2.0	1.6	-
*	GN-1 (SC)	2.5	3.0	2.5	-	2.6
3	IVT-13-3	2.0	2.0	2.0	2.0	-
4	IVT-13-4	1.5	2.5	2.0	2.0	-
*	GN-1 (SC)	3.5	2.5	2.5	-	2.8
5	IVT-13-5	2.0	2.0	2.0	2.0	-
6	IVT-13-6	1.5	2.0	2.0	1.8	-
*	GN-1 (SC)	3.5	2.5	2.5	-	2.8
7	IVT-13-7	2.5	2.5	1.5	2.1	-
8	IVT-13-8	1.5	1.5	1.5	1.5	-
*	GN-1 (SC)	2.5	3.0	3.0	-	2.8
9	IVT-13-9	1.5	2.0	2.0	1.8	-
10	IVT-13-10	2.0	2.0	1.5	1.8	-
*	GN-1 (SC)	2.5	2.5	2.5	-	2.5
11	IVT-13-11	1.5	2.0	1.5	1.6	-
12	IVT-13-12	2.0	2.0	1.5	1.8	-
*	GN-1 (SC)	2.5	2.5	3.0	-	2.6
13	IVT-13-13	1.5	1.5	1.5	1.5	-
*	GN-1 (SC)	3.5	3.5	3.0	-	3.3

Table 3. For, *Alternaria* leaf spot disease

Sr. No.	Treatment	Replication				Maximum Incidence (Score)	
		I	II	III	IV	Test Culture	Control
*	GN-1 (SC)	3.0	3.0	3.0	3.0	-	3.0
1	AVT-13-1	2.5	1.5	2.0	2.0	2.0	-
2	AVT-13-2	2.0	1.5	1.5	2.5	1.8	-
*	GN-1 (SC)	2.0	3.0	3.0	3.5	-	2.8
3	AVT-13-3	1.5	1.5	1.5	2.5	1.7	-
4	AVT-13-4	2.5	1.5	1.5	2.5	2.0	-
*	GN-1 (SC)	3.0	3.0	3.5	3.5	-	3.2
5	AVT-13-5	1.5	1.5	1.5	2.5	1.7	-
6	AVT-13-6	2.0	1.5	1.5	2.5	1.8	-
*	GN-1 (SC)	3.0	3.5	4.0	3.5	-	3.5

Table 4. For, *Cercospora* leaf spot disease

Sr. No.	Treatment	Replication				Maximum Incidence (Score)	
		I	II	III	IV	Test Culture	Control
*	GN-1 (SC)	2.5	3.0	2.5	2.5	-	2.6
1	AVT-13-1	1.5	1.0	1.0	1.0	1.1	-
2	AVT-13-2	1.5	1.5	1.5	1.5	1.5	-
*	GN-1 (SC)	2.5	2.5	2.5	3.0	-	2.6
3	AVT-13-3	1.0	1.0	1.5	1.5	1.2	-
4	AVT-13-4	1.0	1.0	1.0	1.0	1.0	-
*	GN-1 (SC)	2.5	2.5	3.0	3.0	-	2.7
5	AVT-13-5	1.5	1.5	1.5	1.5	1.5	-
6	AVT-13-6	1.5	1.5	2.0	2.0	1.7	-
*	GN-1 (SC)	3.0	2.5	3.0	2.5	-	2.7

Sr. No.	Germplasm lines	<i>Alternaria</i> L.S.	<i>Cercospora</i> L.S.	29	23-4	2.0	2.0
*	GN-1	4.0	2.0	30	89-20	3.0	2.0
1	KEC-6	3.0	2.0	*	GN-1	3.0	2.0
2	RCR-23	3.0	2.0	31	18-64	2.0	2.0
3	RCR-238	2.0	2.0	32	5-70	3.0	2.0
4	RCR-290	2.0	2.0	33	52-26	2.0	2.0
5	RCR-328	2.0	2.0	34	41-50	2.0	2.0
*	GN-1	3.0	3.0	35	71-41	2.0	2.0
6	RCR-317	N G	-	*	GN-1	4.0	3.0
7	KEC-1	2.0	2.0	36	34-14	2.0	2.0
8	KEC-5	3.0	2.0	37	CMB-1-2-3-4	2.0	2.0
9	KEC-8	2.0	2.0	38	PHW-5004-2	2.0	2.0
10	KEC-15	3.0	2.0	39	CH-7	2.0	2.0
*	GN-1	4.0	3.0	40	CHERU NO-1	2.0	1.0
11	PCU-211	3.0	2.0	*	GN-1	3.0	2.0
12	PCU-208	3.0	2.0	41	PCU-191	2.0	2.0
13	PCU-206	2.0	2.0	42	NA-47	2.0	2.0
14	PCU-204	2.0	2.0	43	NA-48	2.0	2.0
15	PCU-200	2.0	2.0	44	PHULE-4	2.0	2.0
*	GN-1	3.0	2.0	45	IGP-272	2.0	2.0
16	PCU-197	1.0	1.0	*	GN-1	4.0	2.0
17	N-122	2.0	2.0	46	IGP-37	2.0	2.0
18	PCU-196	2.0	2.0	47	IGP-234	2.0	1.0
19	PCU-194	2.0	2.0	48	NO-1	2.0	2.0
20	KHN-1	2.0	2.0	49	NO-14-13	2.0	2.0
*	GN-1	4.0	3.0	50	GA-11	3.0	2.0
21	61-30	3.0	2.0	*	GN-1	4.0	2.0
22	5-64	2.0	2.0	51	COMB-2	3.0	2.0
23	5-1	3.0	2.0	52	CH-11	2.0	2.0
24	5-4	2.0	1.0	53	AISI-2	2.0	1.0
25	41- 52	2.0	2.0	54	CH-32	2.0	2.0

.....Continue

*	GN-1	3.0	2.0	55	PHLUE-3	3.0	2.0
26	22-53	2.0	2.0	*	GN-1	4.0	3.0
27	85-26	2.0	2.0	56	KOMKEMP	2.0	2.0
28	89-25	N G	-	57	NB 76-14	3.0	2.0
				58	IGB-14	2.0	2.0
				59	MUTUNAY	2.0	2.0
				60	BPB-1	2.0	2.0
				*	GN-1	4.0	3.0
				61	GA-40	2.0	2.0
				62	IGP-30	2.0	2.0
				63	GOUDAGUDA	3.0	2.0
				64	PCU-188	3.0	2.0
				65	IGP-11	3.0	2.0
				*	GN-1	4.0	3.0
				66	GA-2	2.0	2.0
67	PHULE-2	3.0	2.0	*	GN-1	3.0	2.0
68	IGP-38	3.0	2.0	106	JN-24	2.0	2.0
69	CH-26	3.0	2.0	107	JN-27	3.0	2.0
70	DB-197	3.0	2.0	108	JN-35	2.0	2.0
*	GN-1	4.0	3.0	109	JN-36	2.0	2.0
71	RCR-5-74	3.0	2.0	110	JN-28	2.0	2.0
72	EC-158660	3.0	2.0	*	GN-1	3.0	2.0
73	EC-158669	3.0	2.0	111	JN-29	2.0	2.0
74	EC-158670	3.0	2.0	112	JN-30	2.0	2.0
75	EC-158671	3.0	2.0	113	JN-32	3.0	2.0
*	GN -1	4.0	3.0	114	JN-33	2.0	2.0
76	EC-158672	2.0	2.0	115	JN-37	2.0	2.0
77	EC-158673	3.0	2.0	*	GN-1	4.0	3.0
78	NC-63586	2.0	1.0	116	JN-38	2.0	2.0
79	NC-62592	2.0	2.0	117	JN-39	2.0	2.0
80	NC-3595	2.0	2.0	118	JN-40	2.0	2.0
*	GN-1	4.0	3.0	119	JN-42	2.0	2.0
81	NC-63597	2.0	2.0	120	JN-44	2.0	2.0
82	PCU-183	2.0	2.0	*	GN-1	3.0	2.0
83	PCU-182	2.0	2.0	121	JN-45	2.0	2.0
84	PCU-181	2.0	2.0	122	JN-48	3.0	2.0
85	CWA-1	2.0	2.0	123	JN-49	2.0	2.0
*	GN-1	4.0	3.0	124	JN-57	2.0	2.0
86	IGP-50	N G	-	125	JN-58	2.0	2.0
87	PCU-180	2.0	2.0	*	GN-1	3.0	2.0
88	PCU-179	2.0	1.0	126	JN-68	2.0	2.0
89	SVT-801	2.0	2.0	127	JN-69	2.0	2.0
90	JN-3	2.0	2.0	128	JN-72	3.0	2.0
*	GN-1	4.0	3.0	129	JN-75	2.0	2.0
91	JN-4	2.0	2.0	130	JN-77	2.0	2.0
92	JN-5	2.0	2.0	*	GN-1	4.0	3.0
93	JN-6	2.0	1.0	131	JN-78	2.0	2.0
94	JN-7	2.0	2.0	132	JN-85	2.0	2.0
95	JN-9	2.0	1.0	133	JN-86	3.0	2.0
*	GN-1	4.0	3.0	134	JN-87	2.0	2.0
96	JN-10	2.0	1.0	135	JN-88	2.0	2.0
97	JN-13	2.0	1.0	*	GN-1	4.0	3.0
98	JN-14	2.0	1.0	136	JN-105	2.0	2.0
99	JN-17	2.0	2.0	137	JN-106	2.0	2.0
100	JN-19	2.0	2.0	138	JN-107	2.0	2.0
*	GN-1	4.0	3.0	139	JN-91	2.0	2.0
101	JN-20	2.0	2.0	140	JN-93	2.0	1.0
102	JN-16	2.0	2.0	*	GN-1	4.0	3.0
103	JN-21	2.0	1.0	141	JN-94	2.0	1.0
104	JN-22	2.0	2.0	142	JN-95	3.0	2.0
105	JN-23	3.0	2.0	143	JN-96	2.0	2.0

• N G = Germinated but not established

• GN-1 = Susceptible check

144	JN-98	2.0	2.0	182	NSS-5439	2.0	2
145	JN-99	2.0	1.0	183	NSS-5427	2.0	2
*	GN-1	4.0	3.0	184	NSS-5441	2.0	2
146	JN-100	2.0	2.0	185	NSS-5442	2.0	2
147	JN-109	2.0	2.0	*	GN-1	4.0	3
148	JN-110	2.0	2.0	186	PCU-178	2.0	2
149	JN-112	2.0	2.0	187	PCU-177	2.0	2
150	JN-113	2.0	1.0	188	NSS-5374	N G	-
*	GN-1	4.0	3.0	189	NSS-5490	2.0	2
151	JN-116	2.0	1.0	190	NSS-5393	2.0	2
152	JN-117	2.0	2.0	*	GN-1	4.0	3
153	JN-118	2.0	2.0	191	BMD-64	2.0	2
154	JN-121	2.0	2.0	192	BMD-68	2.0	2
155	JN-122	2.0	2.0	193	BMD-66	2.0	2
*	GN-1	4.0	3.0	194	BMD-76	2.0	2
156	JN-124	2.0	2.0	195	BMD-80	2.0	2
157	JN-128	2.0	2.0	*	GN-1	4.0	3
158	JN-130	2.0	1.0	196	BMD-70	2.0	2
159	JN-131	2.0	2.0	197	BMD-68	2.0	2
160	JN-132	3.0	2.0	198	ASP-127	2.0	2
*	GN-1	4.0	3.0	199	BMD-71	2.0	2
161	JN-133	2.0	2.0	200	BMD-69	2.0	1
162	JN-135	2.0	2.0	*	GN-1	4.0	3
163	JN-138	2.0	2.0				
164	JN-140	3.0	2.0				
165	JN-141	2.0	2.0				
*	GN-1	4.0	3.0				
166	JN-142	2.0	2.0				
167	JN-143	2.0	2.0				
168	JN-144	2.0	2.0				
169	JN-145	2.0	2.0				
170	JN-147	3.0	2.0				
*	GN-1	4.0	3.0				
171	JN-146	2.0	2.0				
172	ONS-107	3.0	2.0				
173	ONS-109	2.0	2.0				
174	ONS-130	3.0	2.0				
175	ONS-133	2.0	2.0				
*	GN-1	4.0	3.0				
176	ONS-135	N G	-				
177	ONS-136	2.0	2.0				
178	ONS-9	2.0	2.0				
179	NSS-5479	2.0	2.0				
180	NSS-5433	2.0	2.0				
*	GN-1	4.0	3.0				
181	NSS-5437	3.0	2.0				

Similarly, six AVT entries including one check were screened against the prevalent diseases. *Alternaria* and *Cercospora* leaf spot were the major diseases during the season. Incidence of *Alternaria* and *Cercospora* leaf spot varied from 1.0 to 2.0 and 1.0 to 2.0 grade respectively as shown in the Table No. 3 and 4. Two hundred germplasm lines from AICRP, Jabalpur were screened along with the check GN-1 against important diseases under field condition. *Alternaria* and *Cercospora* leaf spot varied from 1.0 to 3.0 grade and 1.0 to 2.0 respectively. One entry viz., PCU-197 was found promising for *Alternaria* whereas, PCU-197, 5-4, CHERU No-1, IGP-234, AISI-2, NC-63586, PCU-179, JN-6, JN-9, JN-10, JN-13, JN-14, JN-21, JN-93, JN-94, JN-99, JN-113, JN-116, JN-130 and BMD-69 exhibited the grade of 1.0 against the *Cercospora* infection. This study confirms that differences in resistance to major diseases exist in IVT, AVT and Germplasm of Niger lines. The resistant nature of elite lines observed in present field trials confirmed the cross references by Khanam (1993) and

Ismail *et al.* (2004). These findings suggest that it is possible to improve and screening of the progenies of the parental lines for making disease resistance.

Conclusion

Continuous efforts to locate resistant sources and their utilization in resistance breeding programme are imperative to manage the diseases in the long run. Entry viz., PCU-197 was found promising for *Alternaria* whereas, PCU-197, 5-4, CHERU No-1, IGP-234, AISI-2, NC-63586, PCU-179, JN-6, JN-9, JN-10, JN-13, JN-14, JN-21, JN-93, JN-94, JN-99, JN-113, JN-116, JN-130 and BMD-69 exhibited the grade of 1.0 against the *Cercospora* infection. These findings will help to develop a new set of pathological and genetically desirable disease resistant lines to enhance and sustain Niger productivity.

Acknowledgement

Author thanks All India Coordinated Research Project (AICRP) for providing the required IVT, AVT and Germplasm lines of Niger crop for the conducting the experiment.

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