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Assessment of promising genotypes of pigeonpea against dry root rot disease caused by *Rhizoctonia bataticola* Taub

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Abstract
Thirty three promising medium duration genotypes of pigeonpea including resistant and susceptible check each, were screened through paper towel method for two years (2015 and 2016) to identify sources of resistance against dry root rot. In pigeonpea dry root rot disease is incited by *Rhizoctonia bataticola* (Taub.) Butler [Pycnidial stage: *Macrophomina phaseolina* (Tassi) Goid], is a soil borne fungal pathogen and one of the most destructive soil borne plant pathogen in the world. On the basis of wilting of the plants, discoloration of root as well as rotting of root system, genotypes GRG-820 and GRG-811 were found to be least susceptible (Disease Index 1), while eight genotypes ICP-14832, BDN-2008-8, AGL-1666, AGL-1919, AGL-2013, ICP-8793, AGL-1603 and GRG-177 were ascertained with resistant reaction for dry root rot having disease rating of 3 over the susceptible check cultivar (ICP-13101).

Keywords: Pigeonpea, dry root rot, paper towel method, *Rhizoctonia bataticola*

Introduction
Pigeonpea [*Cajanus cajan* (L.) Millsp.] is an important legume crop of rain fed agriculture in the semiarid tropics and belongs to family leguminaceae. It is one of the major pulse crop grown in the semi-arid tropics between 30°N and 30°S, covering about 50 countries in Asia, Africa and America. It possesses high protein content and is consumed in the form of split pulse as dal, which is extensively cultivated in upland hilly regions as sole as well as intercrop with maize, sorghum, groundnut, soybean and cotton. Globally the crop is grown on area of 7.03 m.ha. With 4.89 m.t. of total production accounting 695 kg/ha of productivity. In India pigeonpea is the second most important pulse crop after chickpea. In India, this crop is grown in an area of 5.6 m.ha. With an annual production of 3.29 m.t. and productivity is 587 kg/ha, which accounts for 80 percent of the pigeonpea area and production of the world. In India, it is mainly grown in Maharashtra, Uttar Pradesh, Madhya Pradesh, Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu, constitutes 90 percent of the area and production of pigeonpea. In Karnataka, the crop is considered as most important pulse crop with an area of 8.17 lakh ha with the production of 5.07 lakh tonnes and productivity of 621 kg/ha [1]. Even though, the crop is accounting about 80 percent of world area and production, there is constraint in the productivity over the years.

Pigeonpea is known to be infected by more than 200 pathogens reported from 23 different countries [2]. Among them few are economically important and wide spread causing heavy losses *viz*., wilt caused by *Fusarium udum*, blight by *Phytophthora drechsleri* F. sp. *cajani*, stem canker by *Macrophomina phaseolina* and pigeonpea sterility mosaic disease transmitted by *tenui virus*. Recently, *Rhizoctonia bataticola* (Taub.) Butler [*Macrophomina phaseolina* (Tassi) Goid] emerged as soil borne pathogen of different agricultural crops including pigeonpea [3]. *R. bataticola* having more than 500 host plants including cultivated and wild plant species belonging to 100 families around the world [4, 5]. The pathogen is very severe especially when an off-season summer crop is taken particularly in black soil [6]. Under favourable condition, disease will infect quickly and cause huge economic losses ranging from 10-100 percent [7]. The pathogen is primarily a soil inhabitant generally affects the fibro-vascular system of the roots which prevents the transport of nutrients and water to the upper parts of the plant. Recently under field condition dry root rot was noticed in pigeonpea as major proportion in the farmer holdings which has significant effect on plant diversity and yield with current scenario of increasing temperature, due to global warming this disease gaining importance in field. Due to its soil inhabitancy the management is very difficult. Hence, the present study was attempted to manage the soil borne disease with host plant resistance sources by screening different germplasms of pigeonpea against *R. bataticola*.

Materials and Methods

Screening of pigeonpea genotypes against dry root rot through blotter paper technique (*In vitro*) was employed during *kharif* 2015and *kharif* 2016. All genotypes were obtained from AICRP on pigeonpea, Agricultural Research Station, Kalaburagi. About 5 mm disc of the culture was placed on potato dextrose agar poured Petriplates and incubated at 25 °C for five days. Five mm disc was cut from the culture and transferred to 250 ml flasks each containing 100 ml potato dextrose broth. After five days of incubation mycelial mats were removed from the flask which were added to 100 ml sterilized distilled water in a beaker after its proper crushing for 1 minute in the blender. Surface sterilized seeds of pigeonpea genotypes were sown on plastic cover containing sterilized soil + sand (1:1). Ten days old seedlings of each genotype were uprooted in such a way that, root system should not be disturbed. The root system of these seedlings was properly washed in running water followed by rinsing in sterilized distilled water. The roots of all genotypes were dipped in the inoculum kept in a beaker with an up and down movement for about 30 seconds and the excess inoculum was removed by touching the roots to the edge of beaker.

Ten seedlings of the each test line were taken and 10 of these were kept separately on two blotter papers (size 45 cm x 25 cm with one fold). The blotter paper was moistened adequately and the seedlings were kept in such a way so that only cotyledons and roots are covered and the green tops of the seedlings remains outside the blotter paper. The seedlings of a susceptible check ICP-13101were also inoculated with each batch of test seedlings. The folded blotter papers were kept in a tray along with susceptible check. These trays were placed into the incubator at 35 °C for eight days. Artificial light was provided for 12 hrs and the blotter papers were moistened adequately on alternate day.

Rating scale

In order to find out the resistant genotype of pigeonpea, test lines were scored at the end of the incubation period by examining the seedlings for the extent of root damage and were scored for the disease on 1-9 point scale as mentioned below:

Rating	Infection	Description	Reaction
1	No mortality	No infection on roots	Highly Resistant (HR)
3	0-10% mortality	Very few small lesions on roots	Resistant (R)
5	11-20% mortality	Lesions on roots clear but small; new roots free from infection	Moderately Resistant (MR)
7	20-50% mortality	Lesions on roots many; new roots generally free from lesions	Susceptible (S)
9	>51% mortality	Roots infected and completely discoloured	Highly Susceptible (HS)

The mean percent root rot of all the genotypes was calculated by taking the average of incidence in both the years.

Results and Discussion

Thirty three promising medium duration genotypes of pigeonpea including resistant and susceptible check each, were screened through paper towel method during *kharif* 2015 and *kharif* 2016 to identify sources of resistance against dry root rot. Among 31 genotypes screened for dry root rot (Table 1 & 2), only two genotypes namely GRG-820 and GRG-811 have not shown any symptoms of browning and infection on roots hence were considered as highly resistant against dry root rot incidence. On the other hand eight genotypes *viz*., ICP-14832, BDN-2008-8, AGL-1666, AGL-1919, AGL-2013, ICP-8793, AGL-1603 and GRG-177 were shown very few small brown lesions on roots of the genotypes with percent root rot incidence ranging from 4.2 to 7.84 hence were grouped under resistant reaction. Similarly, five genotypes (ICP-7223, MARUTI, PRIL-B-136, AKT-9913 and GRG-2013) were grouped under moderately resistant reaction, shows small lesions on roots where new roots are free from infection by recording 13.80 to 17.61 percent root rot incidence. The remaining genotypes had varied degrees of susceptible reaction with more than 20 percent mortality. In addition, genotypes *viz*., TDRG-33, ICP-11320, AGL-2249, GRG-152, NTL-900 and ICPL-14001 had shown complete decaying and detachment of root system. This might be due to the susceptibility of pigeonpea genotypes to *R. bataticola* by the higher activity of pectin and polygalactouronate trans-eliminase and reduced activity of these enzymes was observed in resistant genotypes [8].

Twenty four pigeonpea genotypes were evaluated against *Macrophomina phaseolina*[9], none of the genotypes showed immune reaction. However, two genotypes PT-221 and ICPL-90097 had resistant reaction and DEPS-9, Gullalli local, GS-1, ICPL-89049, Phy-K-2, TAT-9621 and V-50 recorded moderately resistant reaction.

Conclusion

The research may be concluded from the study that, the two pigeonpea genotypes *viz*., GRG-820 and GRG-811 found resistant to dry root rot and the same genotypes can be used in the breeding programme as resistant source against *M. phaseolina*.

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Table 1: Reaction of pigeonpea genotypes to dry root rot caused by *R. bataticola* in Blotter paper technique.

Sl. No.	Genotypes	Origin	Dry root rot incidence (%)			Reaction
			2015	2016	Mean	
1	ICP-7223	LSD (MD)-11	15.65	18.16	16.91	MR
2	ICP-13673	LSD (MD)-11	82.32	75.62	78.97	HS
3	GRG-111	LSD (MD)-11	69.62	87.36	78.49	HS
4	GRG-444	LSD (MD)-11	38.51	42.53	40.52	S

5	ICP-88039-1	LSD (MD)-11	40.21	41.59	40.90	S
6	ICP-14832	LSD (MD)-11	4.08	5.16	4.62	R
7	BDN-2008-8	LSD (MD)-11	6.89	6.15	6.52	R
8	GRG-820	LSD (MD)-11	0	0	0.00	HR
9	AGL-1666	LSD (MD)-11	6.4	7.52	6.96	R
10	AGL-1919	LSD (MD)-11	7.08	8.59	7.84	R
11	MARUTI	LSD (MD)-11	16.97	18.25	17.61	MR
12	GRG-811	LSD (MD)-11	0	0	0.00	HR
13	TDRG-33	LSD -2 (MD)-8	68.25	78	73.13	HS
14	AGL-2013	LSD -2 (MD)-8	5.49	6.89	6.19	R
15	PRIL-B-136	LSD -2 (MD)-8	12.35	15.24	13.80	MR
16	ICP-11320	LSD -2 (MD)-8	59.65	65.28	62.47	HS
17	ICP-8793	LSD -2 (MD)-8	5.26	7.08	6.17	R
18	AGL-1603	LSD -2 (MD)-8	4.29	4.11	4.20	R
19	AGL-2249	LSD -2 (MD)-8	56.9	62.23	59.57	HS
20	ICPL-99050	LSD -2 (MD)-8	73.12	82.56	77.84	HS
21	GRG-177	MLT (MD)-11	6.59	8.12	7.36	R
22	GRG-151	MLT (MD)-11	76.12	79.64	77.88	HS
23	GRG-152	MLT (MD)-11	92.35	94.5	93.43	HS
24	NTL-900	MLT (MD)-11	89.65	92.16	90.91	HS
25	ICPL-14001	MLT (MD)-11	75.65	80.32	77.99	HS
26	AKT-9913	MLT (MD)-11	16.59	18	17.30	MR
27	ICP-16264	MLT (MD)-11	63.21	62.59	62.90	HS
28	GRG-2013	MLT (MD)-11	14.29	16.08	15.19	MR
29	GRG-140	MLT (MD)-11	82.54	83	82.77	HS
30	GRG-222	MLT (MD)-11	32.65	38.41	35.53	S
31	BDN-2008-1	MLT (MD)-11	42.31	44.29	43.30	S
32	ICP-13101	Susc. check	70.95	73.15	72.05	HS
33	TS-3R	Res. check	5.65	6.05	5.85	R

Table 2: Categorization of pigeonpea genotypes screened against dry root rot through Blotter paper technique.

Sl. No	Reaction	Rating	Genotypes
1	Highly Resistant (HR)	1	GRG-820 and GRG-811
2	Resistant (R)	3	ICP-14832, BDN-2008-8, AGL-1666, AGL-1919, AGL-2013, ICP-8793, AGL-1603 and GRG-177
3	Moderately Resistant (MR)	5	ICP-7223, MARUTI, PRIL-B-136, AKT-9913 and GRG-2013
4	Susceptible (S)	7	GRG-444, ICP-88039-1, GRG-222 and BDN-2008-1
5	Highly Susceptible (HS)	9	ICP-13673, GRG-111, TDRG-33, ICP-11320, AGL-2249, ICPL-99050, GRG-151, GRG-152, NTL-900, ICPL-14001, ICP-16264 and GRG-140

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