

Screening of Chickpea Genotypes/varieties against Sclerotinia Rot of Chickpea caused by *Sclerotinia sclerotiorum* (Lib.) de Bary under Artificial conditions

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ABSTRACT: The present investigation was carried out in artificial conditions of College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner (Rajasthan), India during the year 2016-17 and 2017-18. Forty genotypes/varieties of chickpea were screened for reactions against Sclerotinia rot, caused by soil-borne *Sclerotinia sclerotiorum* under artificial conditions. Out of forty genotypes/varieties of chickpea screened, none was found completely free from *S. sclerotiorum* infection. None of genotypes/varieties were found moderately resistant (MR) to Sclerotinia rot. Whereas, four genotypes/varieties i.e. GNG-1581, RSG-888, RSG-973 and H-208 were categorized as moderately susceptible (MS) and thirty five genotypes/varieties i.e. GNG-1958, GNG-663, GNG-469, GNG-1969, GNG-1488, GNG-1499, RSG-44, RSG-945, RSG-807, C-235, GNG-146, GNG-1292, CSJD-884, RSG-895, RSG-991, RSG-896, RSG-902, RSG-974, CSJK-21, GNG-2144, Dohad Yellow, K-850, L-550, RSG-584, GNG-2171, ICC-96030, JKG-1, ICC-16644, ICC-17109, BG-379, Chaffa, Radhey, BG-2078, BG-256 and HK-98-155 were assessed as susceptible (S). Rests of RSG-963 genotypes/varieties were recorded as highly susceptible (HS) to *S. sclerotiorum* infection in chickpea during Rabi 2016-17 and Rabi 2017-18. Development of resistance or tolerant chickpea varieties to *Sclerotinia sclerotiorum* is challenging since the pathogen is having a wide host range. Hence, knowledge of pathogenic variability is essential in making strategies for developing disease resistant varieties and development of resistant gene in the region.

Keywords: Chickpea, Genotypes, Sclerotinia rot, Screening and *Sclerotinia sclerotiorum*.

INTRODUCTION

Sclerotinia rot also known as Sclerotinia wilt or white mold, caused by *Sclerotinia sclerotiorum* is a serious disease of chickpea. It infects all the economically important food and feed legumes (Pratt and Knight 1984). This fungus has a wide host range and has a worldwide distribution on numerous crops (Purdy, 1979; Boland and Hall 1994). It is one of the destructive pathogen associated with root rot/wilt complex of chickpea and its occurrence is increasing in both incidence and severity on chickpea grown in the Mediterranean region (Anon., 1996). The initial infection occurs in the late winter or early spring, and the fungal mycelia grow within and between plants. Patches like symptoms of dead plant parts enlarge and coalesce through spring and cause major losses in stands (Bolton *et al.*, 2006). The fungus produces many black fleshy structures called Sclerotia, which survive from one cropping season to the next. Over-wintered Sclerotia may germinate during the summer or may remained dormant for many years (Adams and Ayers 1979). The etiology, biology and epidemiology of the

fungus had been studied extensively by several workers (Phillips, 1987; Purdy, 1979; Roberts *et al.*, 1982). Cultivation of resistant varieties is the ideal and feasible control of the disease and no resistant varieties against this disease has been identified so far. Erect type cultivars can better withstand against the disease and management can also minimize the crop losses. Stable resistance could not be achieved due to the prevalence of virulent isolates of *S. sclerotiorum* (Sharma *et al.*, 2002). Management of Sclerotinia rot of chickpea through alone chemical is less effective as *S. sclerotiorum* having a broad host range and survives in soil for long periods in the form of Sclerotia. The Sclerotia will survive up to ten years even in the absence of the host plants and beneath prevailing dry soil conditions. Use of host plant resistance is the most economical strategy for management of Sclerotinia rot in chickpea. Therefore, the present study was undertaken to evaluate different genotypes/varieties of chickpea to identify resistant against sclerotinia rot disease by means of disease indexing under field conditions.

MATERIAL AND METHODS

In the present investigation, forty chickpea genotypes/varieties were evaluated to find out the resistance reaction against sclerotinia rot under artificial conditions (Table 1). The experiment was laid out in completely random design which was replicated twice during *Rabi* 2016-17 and 2017-18. Seeds of all the accessions were surface sterilized with Clorox solution (0.1% available chlorine) for 2 minutes and sown in disposable pots (7.5 × 15 cm) filled with sterilized soil and sand mixture (2:1). Each pot contained five chickpea seedlings. A *Sclerotinia* rot susceptible chickpea variety, C-235 was included as control for comparison and spread of the disease. Pots were kept under greenhouse at 20+2°C in natural light for 15 days before inoculation. Pots were watered from the top prior to inoculation. Two week old seedlings were inoculated by spraying aqueous spore suspension having a concentration of 5×10^8 spores/ml. The inoculum was prepared from 15 days old culture of *S. sclerotiorum* multiplied on chickpea grains. The inoculated seedlings were incubated in humid chamber 20+20°C for 72 h in the greenhouse, and were continuously sprayed with water. Disease observations were taken when susceptible check pots were completely killed. Disease scoring was recorded on 0-4 disease rating scale (Lesovoi *et al.*, 1987).

$$\text{Per cent disease incidence (PDI \%)} = \frac{\text{Total number of infected plants}}{\text{Total number of plants observed}} \times 100$$

RESULT AND DISCUSSION

In the present experiment, total forty chickpea genotypes/varieties were evaluated under artificial inoculation conditions during *Rabi* 2016-17 and 2017-18. During *Rabi* 2016-17, none was found resistant (R) and moderately resistant (MR) against *Sclerotinia* rot disease. The eight genotypes/varieties *viz.*, GNG-1581, GNG-1488, GNG-1499, RSG-888, RSG-807, H-208, RSG-973 and Radhey were assessed as moderately susceptible (MS) while thirty two genotypes/varieties GNG-469, GNG-1958, GNG-663, GNG-1969, RSG-44, RSG-945, RSG-963, C-235, GNG-146, GNG-1292, CSJD-884, RSG-895, RSG-991, RSG-896, RSG-902, RSG-974, CSJK-21, GNG-2144, Dohad yellow, K-850, L-550, RSG-584, GNG-2171, ICC-96030, JKG-1, ICC-16644, ICC-17109, BG-379, Chaffa, BG-2078, BG-256 and HK-98-155 were recorded as susceptible. None was found highly susceptible.

During *Rabi* 2017-18, above forty chickpea genotypes/varieties were again evaluated under artificial inoculation conditions. The disease incidence and disease reaction for each genotypes/varieties are presented in Table 1 and 2. The data presented in table 2 indicates that out of forty genotypes/varieties tested, during *Rabi* 2017-18, none was found resistant (R) and moderately resistant (MR) to *Sclerotinia* rot disease. However, three genotypes/varieties namely GNG-1581, RSG-888 and H-208 were found moderately susceptible (MS) against *Sclerotinia* rot. Rest of thirty five chickpea genotypes/varieties were categorized as susceptible (S) against the disease. Rest of two genotypes/varieties namely RSG-963 and C-235 were grouped under highly susceptible category against the disease.

Table 1: Reaction of different genotypes/varieties against *Sclerotinia* rot of chickpea under artificial condition (*Rabi* 2016-17).

Genotypes/Varieties	Category of infection	Host reaction
Nil	0	Resistant (R)(PDI=<1%)
Nil	1	Moderately Resistant (MR) (PDI=1-10%)
GNG-1581, GNG-1488, GNG-1499, RSG-888, RSG-807, H-208, RSG-973, RADHEY (8)	2	Moderately Susceptible (MS) (PDI= 10-20 %)
GNG-469,GNG-1958, GNG-663, GNG-1969, RSG-44, RSG-945,RSG-963, C-235, GNG-146, GNG-1292, CSJD-884, RSG-895, RSG-991, RSG-896, RSG-902, RSG-974, CSJK-21, GNG-2144, DOHAD YELLOW, K-850, L-550, RSG-584, GNG-2171,ICC-96030, JKG-1, ICC-16644, ICC-17109, BG-379, CHAFFA, BG-2078, BG-256, HK-98-155 (32)	3	Susceptible (S) (PDI= 20-50 %)
Nil	4	Highly Susceptible (HS) (PDI=>50 %)

Table 2: Reaction of different genotypes/varieties against Sclerotinia rot of chickpea under artificial condition (Rabi 2017-18).

Genotypes/Varieties	Category of infection	Host reaction
Nil	0	Resistant (R) (PDI=<1%)
Nil	1	Moderately Resistant (MR) (PDI=1-10%)
GNG-1581, RSG-888, H-208 (3)	2	Moderately Susceptible (MS) (PDI= 10-20 %)
GNG-469,GNG-1958, GNG-663,GNG-1969,GNG-1488, GNG-1499, RSG-44, RSG-945, RSG-807, GNG-146, GNG-1292, CSJD-884, RSG-895, RSG-973, RSG-991, RSG-896, RSG-902, RSG-974, CSJK-21, GNG-2144, DOHAD YELLOW, K-850, L-550, RSG-584, GNG-2171, ICC-96030, JKG-1, ICC-16644, ICC-17109, BG-379, CHAFFA, RADHEY, BG-2078, BG-256, HK-98-155 (35)	3	Susceptible (S) (PDI= 20-50 %)
RSG-963, C-235 (2)	4	Highly Susceptible (HS) (PDI=>50 %)

Table 3: Reaction of different genotypes/varieties against Sclerotinia rot of chickpea under artificial condition (Pooled).

Genotypes/Varieties	Category of infection	Host reaction
Nil	0	Resistant (R) (PDI=<1%)
Nil	1	Moderately Resistant (MR) (PDI=1-10%)
GNG-1581,RSG-888,H-208, RSG-973 (4)	2	Moderately Susceptible (MS) (PDI= 10-20 %)
GNG-469, GNG-1958, GNG-663, GNG-1969, GNG-1488, GNG-1499, RSG-44, RSG-945, RSG-807, C-235, GNG-146, GNG-1292, CSJD-884, RSG-895, RSG-991, RSG-896, RSG-902, RSG-974, CSJK-21, GNG-2144, DOHAD YELLOW, K-850, L-550, RSG-584, GNG-2171, ICC-96030, JKG-1, ICC-16644, ICC-17109, BG-379, CHAFFA, RADHEY, BG-2078, BG-256, HK-98-155(35)	3	Susceptible (S) (PDI= 20-50 %)
RSG-963(1)	4	Highly Susceptible (HS) (PDI=>50 %)

Table 4: Reaction of chickpea genotypes/varieties against Sclerotinia rot under artificial condition.

Sr. No.	Genotypes /Varieties	Rabi 2016-17		Rabi 2017-18		Mean	
		Disease incidence (%)	Disease reaction	Disease incidence (%)	Disease reaction	Disease incidence (%)	Disease reaction
1.	GNG-1581	13.83(21.83)*	MS	15.52(23.20)	MS	14.67(22.52)	MS
2.	GNG-1958	30.09(33.26)	S	31.37(34.06)	S	30.73(33.66)	S
3.	GNG-663	33.87(35.58)	S	35.57(36.61)	S	34.72(36.10)	S
4.	GNG-469	23.25(28.82)	S	25.27(30.17)	S	24.26(29.50)	S
5.	GNG-1969	21.23(27.43)	S	25.98(30.64)	S	23.60(29.06)	S
6.	GNG-1488	19.93(26.51)	MS	25.66(30.43)	S	22.79(28.51)	S
7.	GNG-1499	19.00(25.84)	MS	26.47(30.96)	S	22.73(28.47)	S
8.	RSG-44	37.20(37.58)	S	45.86(42.62)	S	41.53(40.12)	S
9.	RSG-888	13.63(21.66)	MS	15.23(22.97)	MS	14.43(22.32)	MS
10.	RSG-945	24.80(29.86)	S	32.27(34.61)	S	28.53(32.28)	S
11.	RSG-807	19.90(26.49)	MS	23.55(29.03)	S	21.72(27.77)	S
12.	RSG-963	48.00(43.85)	S	56.36(48.65)	HS	52.18(46.24)	HS
13.	C-235	44.26(41.70)	S	51.36(45.77)	HS	47.81(43.74)	S
14.	H-208	11.80(20.09)	MS	13.46(21.52)	MS	12.63(20.81)	MS

Sr. No.	Genotypes /Varieties	Rabi 2016-17		Rabi 2017-18		Mean	
		Disease incidence (%)	Disease reaction	Disease incidence (%)	Disease reaction	Disease incidence (%)	Disease reaction
15.	GNG-146	27.54(31.65)	S	33.26(35.21)	S	30.40(33.46)	S
16.	GNG-1292	40.60(39.58)	S	40.24(39.37)	S	40.42(39.47)	S
17.	CSJD-884	21.30(27.48)	S	27.04(31.33)	S	24.17(29.44)	S
18.	RSG-895	31.70(34.26)	S	38.67(38.45)	S	35.18(36.37)	S
19.	RSG-973	16.78(24.18)	MS	22.45(28.28)	S	19.61(26.28)	MS
20.	RSG-991	28.44(32.22)	S	33.05(35.09)	S	30.74(33.67)	S
21.	RSG-896	37.04(37.48)	S	45.96(42.68)	S	41.50(40.10)	S
22.	RSG-902	25.26(30.17)	S	32.90(35.00)	S	29.08(32.63)	S
23.	RSG- 974	37.68(37.86)	S	45.70(42.53)	S	41.69(40.21)	S
24.	CSJK-21	37.30(37.64)	S	47.30(43.45)	S	42.30(40.57)	S
25.	GNG-2144	40.65(39.61)	S	48.40(44.08)	S	44.52(41.85)	S
26.	DOHAD YELLOW	41.43(40.06)	S	48.69(44.24)	S	45.06(42.16)	S
27.	K-850	23.78(29.18)	S	28.34(32.16)	S	26.06(30.69)	S
28.	L-550	44.40(41.78)	S	49.36(44.63)	S	46.88(43.21)	S
29.	RSG-584	37.76(37.91)	S	43.20(41.09)	S	40.48(39.51)	S
30.	GNG-2171	35.65(36.66)	S	41.80(40.28)	S	38.72(38.48)	S
31.	ICC-96030	35.32(36.46)	S	42.80(40.86)	S	39.06(38.68)	S
32.	JKG-1	28.00(31.94)	S	33.20(35.18)	S	30.60(33.58)	S
33.	ICC-16644	41.00(39.81)	S	48.80(44.31)	S	44.90(42.07)	S
34.	ICC-17109	24.81(29.87)	S	32.35(34.66)	S	28.58(32.31)	S
35.	BG-379	27.76(31.76)	S	34.81(36.15)	S	31.28(34.00)	S
36.	CHAFFA	38.23(38.19)	S	43.20(41.09)	S	40.71(39.64)	S
37.	RADHEY	19.53(26.22)	MS	25.70(30.46)	S	22.61(28.39)	S
38.	BG-2078	36.20(36.98)	S	41.90(40.33)	S	39.05(38.67)	S
39.	BG-256	33.12(35.13)	S	39.79(39.10)	S	36.45(37.13)	S
40.	HK-98-155	40.20(39.34)	S	49.20(44.54)	S	44.70(41.95)	S
	S.Em ±	0.77		0.93		1.70	
	C.D (P=0.05)	2.38		2.86		5.24	
	C.V (%)	8.05		8.13		8.09	

*Figures in parentheses are angular transformed values

On the basis of all two year pooled data (Rabi 2016-17 & 2017-18) (Table 4), the genotypes/varieties were classified in five groups *viz.*, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible. Out of forty genotypes/varieties tested under artificial inoculated conditions during both Rabi season 2016-17 and 2017-18, none was found completely free from *S. sclerotiorum* infection. However, none genotypes/varieties was found moderately resistant (MR). The four genotypes/varieties were assessed as moderately susceptible (MS) and thirty five genotypes/varieties were categorized as susceptible (S). One was recorded as highly susceptible (HS) to *S. sclerotiorum* infection in chickpea during both the Rabi seasons. The chickpea variety GNG-1581, RSG-888, and H-208 were found moderately

susceptible (MS) during both the seasons 2016-17 and 2017-18, respectively but considered under susceptible (S) category on the basis of average of both the Rabi season. The results of the present studies are in agreement with the earlier observations made by Singh *et al.* (1994) had screened twelve Brassica sp. in experiments under natural and artificial conditions. None of the species tested showed resistance under high inoculum pressure in the greenhouse. Akem *et al.* (1999) have screened fifteen chickpea genotypes *in vivo* condition against *S. sclerotiorum* and found that five exhibited some resistance to Sclerotinia stem rot. This was shown by delayed initial infection, restricted lesion development and no sclerotial production. Chaturvedi and Dua (2009) have screened twenty-five resistant cultivars, whose KPG 59, Radhey and K 50 were found

to be most promising against dry root rot of chickpea. Sharma *et al.*, (2018) have reported a total of hundred rapseed and mustard genotypes were screened for resistance to Sclerotinia rot under artificial stem inoculation condition in the sick plot. Out of hundred genotypes, eight genotypes were resistant Wagh *et al.* (2018). Out of one hundred twenty seven chickpea genotypes were evaluated against dry root rot through disease sick fields. Out of three entries were found resistant.

CONCLUSIONS

From the present investigation it is concluded that four genotypes/varieties were analyzed as moderately susceptible (MS) viz., GNG-1581, RSG-888, H-208, RSG-973.

FUTURE SCOPE

Resistant genotypes/varieties identified in the present research may be used further to develop improved genotypes/varieties against sclerotinia rot, which can help to boost production and productivity of chickpea.

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Conflict of Interest. None.

REFERENCES

- Adams, P. B. and Ayers, W. A. (1979). Ecology of Sclerotinia species. *Phytopathology*, 69, 896-898.
- Akem and Khabbabe (1999). Screening for resistance to Sclerotinia stem rot in chickpea: A simple technique. *Pak. J. Biol. Sci.*, 2(2), 277-279.
- Anonymous (1996). Annual Report, Legume Program, International Centre for Agricultural Research in the Dry Areas (ICARDA), pp. 316.
- Boland, G. J. and Hall, R. (1994). Index of plant hosts of *Sclerotinia sclerotiorum*. *Can. J. Pl. Pathol.*, 16, 93-108.
- Bolton, N. D., Thoma, P. H. J. and Nelson, B. D. (2006). *Sclerotinia sclerotiorum* (Lib) de Bary: Biology and molecular traits of cosmopolitan pathogen. *Molecular Plant Pathology*, 7, 1-16.
- Chaturvedi, S. K. and Dua, R. P. (2009). Improved varieties of chickpea in India. *Bull. Kanpur. pp.* 1-10.
- Lesovoi, M. P., Parfenyuk, A.I. and Kondrafyuk, O. K. (1987). A method of identifying and selecting sunflower resistant to pathogen of white and gray mould. *Mikollogiya Fitopatologiya*, 21, 273-278.
- Phillips, A. J. I. (1987). Carpogenic germination of Sclerotinia white mold (*Sclerotinia sclerotiorum*) in bean (*Phaseolus vulgaris*). *Med. Fac. Landbouww. Rijksuniv. Gent.*, 53, 787-796.
- Prat, R. G. and Knight, W. E. (1984). Foundation of apothecia by Sclerotia of *Sclerotinia trifoliorum* and infection of crimson clover in the field. *Plant Disease*, 66, 1021-1023.
- Purdy, L. H. (1979). *Sclerotinia sclerotiorum*: History, diseases and symptomatology, host range, geographic distribution and impact. *Phytopathology*, 69, 875-880.
- Robert, M. E., Dickson, M. H. and Hunter, J. E. (1982). Heritability of white mold resistance. *Annual Report Bean Improvement Cooperation*, 25, 104.
- Sharma, B. K., Singh, U. P. and Singh, K. P. (2002). Variability in Indian isolates of *Sclerotium rolfsii*. *Mycologia*, 96, 1051-1058.
- Sharma, P., Singh, S., Singh, V. V., Gupta, N. C., Prasad, L., Meena, P. D., Ambawat, S. and Rai, P. K. (2018). Identification and characterization of new resistance sources against Sclerotinia stem rot (in Oilseed *Sclerotinia sclerotiorum*) Brassica. *J. Mycol. Pl. Pathol.*, 48(1), 47-56.
- Singh, R., Tripathi, N. N. and Singh, R. (1994). Assured method of inoculation and screening of Brassica sp. against *Sclerotinia sclerotiorum* (Lib.) de Bary. *Crop Res.*, 8, 570-574.
- Wagh, P., Khare, N. and Dantre, R. K. (2018). Screening for resistance against *Rhizoctonia bataticola* causing Dry Root Rot in Chickpea (*Cicer arietinum* L.). *Int. J. Curr. Microbiol. App. Sci.*, 7(6), 2578-2581.

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