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SCREENING OF GERMPLASMS FOR RESISTANCE TO BOTRYTIS GRAY MOLD OF CHICKPEA

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ABSTRACT

Hossain MA, Mondol MEA, Rashid MH, Rahman H, Hasnat MR (2013) Screening of germplasms for resistance to botrytis gray mold of chickpea. *Int. J. Sustain. Crop Prod.* 8(1), 16-21.

The experiment was conducted at RARS, BARI, Rahmatpur, Barisal to find out the resistant source of Botrytis Gray Mold (BGM) of chickpea under natural epiphytotic condition. Fifty two chickpea germplasms/variety were used and finally 23 germplasms/variety were selected during 2012-2013. Out of 23 chickpea germplasms, 18 germplasms showed highly resistant (HR) and 5 germplasms observed resistant (R) at flowering stage, one germplasm (BD-6041) showed highly resistant (HR) and 22 germplasms showed resistant (R) at pod setting stage, 22 germplasms found resistant (R) and one variety (BARI Chickpea-5) showed Highly Susceptible (HS) reaction at the maturity stage. Out of tested 23 germplasms/varieties the tallest (56.50 cm) plant was found in check variety BARI Chickpea 9 and the shortest plant (29.40 cm) was recorded in case of germplasm BD-6346. The maximum duration for maturity (137 days) was recorded in germplasm BD-6352 and the minimum duration (134.5 days) was recorded in germplasm BD-6036. The highest 100-seed weight was 24.50 g (BARI Chickpea-9) and the lowest 100-seed weight was 8.00 g (BD-6042). The maximum yield was recorded 1660.0 kg/ha from germplasm BD-6352 and the minimum yield was recorded 340.0 kg/ha from germplasm BD-6036 and BD-6041.

Key word*: chickpea, bgm, screening, yield*

INTRODUCTION

Chickpea (*Cicer arietinum*) is the world's third most important food legume in the world, and one of the most important pulse crop in Bangladesh. Chickpea was the third most important pulse crops up to mid nineteen. During 2010, the global chickpea area was 12.0 million ha, production was 10.9 million MT and yield was 913 kg/ha. But its area has gone down from 0.10367 lac ha in 1990-1991 to 0.071 lac ha in 2011-2012 and ranks 7th among the pulses in Bangladesh (Krishi Diary, 2013). Globally a total of 172 pathogens which include fungi, bacteria, virus, nematodes and mycoplasma like organisms (MLOs) have been recorded on chickpea growing countries of the world (Nene *et al.* 1984). In Bangladesh out of 126 diseases of pulses so far 17 diseases of chickpea have been recorded (Bakr and Rashid, 2007). Botrytis grey mould (BGM), caused by *Botrytis cinerea* Pers. ex. Fr., is the second most potentially serious disease of chickpea after Ascochyta blight. BGM can devastate chickpea, resulting in complete yield loss in years of extensive winter rains and high humidity (Pande *et al*. 2002). BGM appeared as one of the most damaging diseases of chickpea in Bangladesh, which may cause 100% yield loss (Bakr *et al.* 1998). It was first reported in 1981 in Bangladesh (Ahmed *et al*. 1981). The disease is seed, soil and air borne. In the recent years, this disease has become a great threat to chickpea cultivation. Preventive measures such as low seed rate, chemical spray, wider row spacing, intercrop with linseed help to reduce disease intensity. But resistant cultivars offer the best solution to control the disease.

Botrytis gray mold is an economically important disease of chickpea (*Cicer arietinum* L.), especially in cool, cloudy, and humid weather condition in the world. In Bangladesh, BGM is the most important fungal chickpea disease able to cause complete crop loss has reduced traditional cropping regions by 70% over the past decade. The pathogen *B. cinerea* mainly survives between seasons on infected crop debris and seeds. Despite extensive investigations on pathological, physiological and molecular characteristics of *B. cinerea* causing gray mold type diseases on chickpea and several other hosts, the nature of infection processes and genetic basis of pathogen variability have not been clearly established. This lack of information coupled with the need for repeated application of chemical fungicides forced the deployment of host plant resistance (HPR) as a major option for BGM management. Effective and repeatable controlled-environment and field-screening techniques have been developed for identification of HPR. Of the selected portion of chickpea germplasm evaluated for BGM resistance, only few accessions belonging to both cultivated and wild *Cicer* spp. were tolerant to BGM, and the search for higher levels of disease resistance continues. As the pathogen of the disease is soil, seed and air borne and it is difficult to control the BGM disease by a single management options. One of the best control methods of disease management programme that is being currently investigated with the idea of avoiding environmental pollution is the study of genetic materials for finding desirable resistance against Botrytis gray mold.

MATERIALS AND METHODS

The experiment was carried out at experimental field of Regional Agricultural Research Station (RARS), Bangladesh Agricultural Research Institute (BARI), Rahmatpur, Barisal during the period from November, 2012 to April, 2013 in order to study the severity of diseases and yield of Chickpea. The experiment was conducted in Randomized Complete Block Design (RCBD) with two replications. The size of the individual plot was 2.5 m length single row. The spacing was 40 cm × 10 cm. BARIchickpea-5 and BARIchickpea-9 were sown as check.

To minimize the seed borne pathogen, seeds were treated with Bavistin 50 WP @ 3gm/kg seed. Fertilizers were applied at the time of final land preparation as per recommended doses. Intercultural operation was done in order to maintain the normal hygienic condition of crop growth. Weeding was performed three times during the growing period of the crop while 20, 35 and 50 days after sowing. The severity of BGM was recorded at flowering stage (65 DAS), pod setting stage (85 DAS) and maturity stage (115 DAS). Disease severity data were recorded three times on the basis of on a 1-9 severity scoring scale as described by Singh (1999). Data were recorded on the following parameters, Plant type, plant stand, flower Color, plant height, Days to maturity, number of branch/plant, number of total pod/plant, number of Seeds/Pod (10 pods), 100 seeds weight (g), yield (kg/ha). The collected data were analyzed statistically. Analysis of variance and LSD test were done to find out the significant difference among the treatment means.

RESULTS AND DISCUSSION

Disease reaction of chickpea Botrytis Gray Mold during 2012-2013

Flowering stage

At flowering stage, out of 52 germplasms/varieties one, 19, 26 and 6 germplasms/varieties showed significant difference, and scoring scale-2, scoring scale-3, scoring scale-4 and scoring scale-5, respectively.

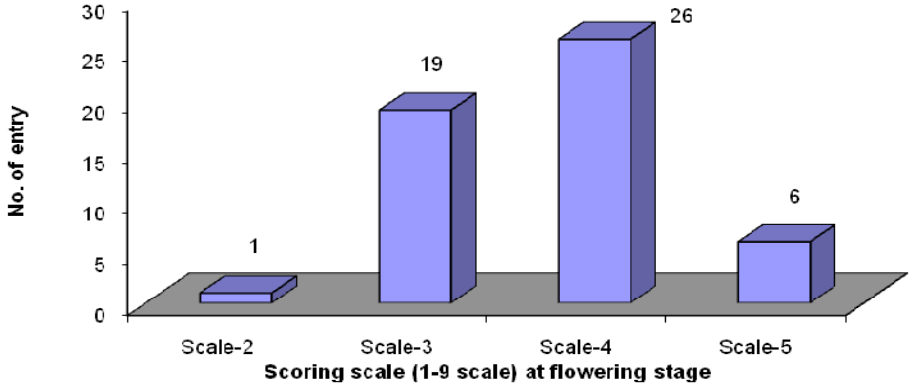

Fig. 1. Disease reaction of 52 chickpea genotypes against BGM at flowering stage

Pod setting stage

Out of 52 germplasms/varieties one, 16, 28 and 7 germplasms/varieties were showed significant difference and observed scoring scale-3, scoring scale-4, scoring scale-5 and scoring scale-6, respectively (Fig. 2).

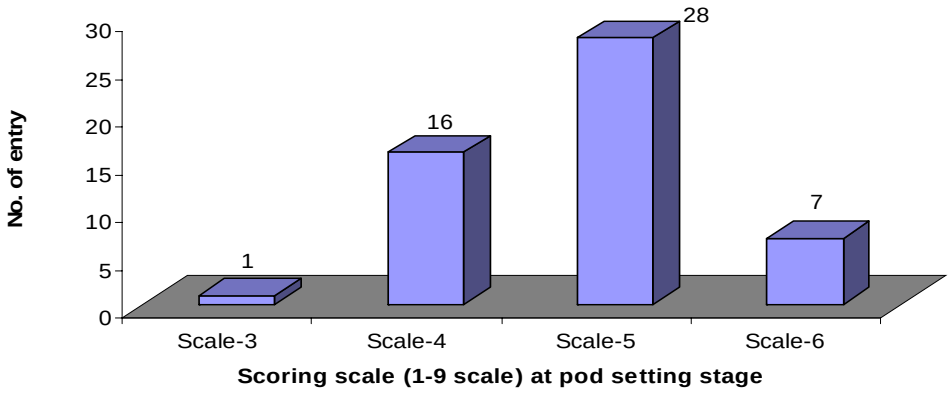

Fig. 2. Disease reaction of 52 chickpea genotypes against BGM at pod setting stage

Maturity stage

At the maturity stage, out of 52 germplasms/varieties 2, 20, 24, 5 and one germplasm showed Scoring scale-4, scoring scale-5, scoring scale-6, scoring scale-7 and scoring scale-8, respectively.

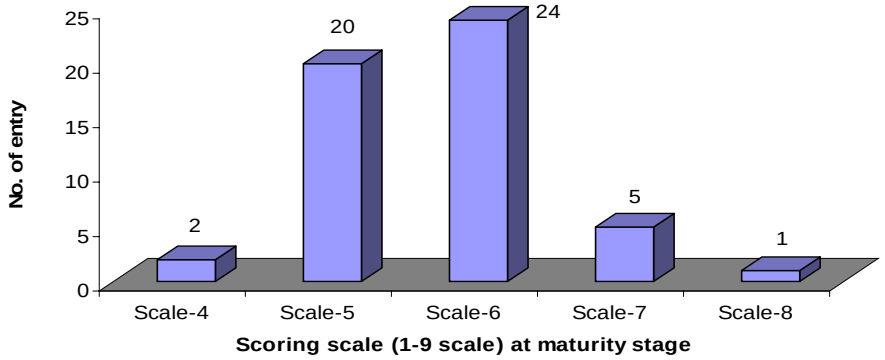

Fig. 3. Disease reaction of 52 chickpea genotypes against BGM at maturity stage

On the basis of disease reaction 22 germplasm showed Resistant (R) reaction which was graded as scale 4 and 5. The resistant 22 germplasm and one susceptible check (BARI Chickpea-5) were investigated for yield and yield contributing characters.

These findings corroborate with the findings of other researchers. Singh *et al*. (1997) screened 2550 chickpea lines were in a growth chamber in 1992-1995. Five chickpea lines, *viz*. PGL 700, GL 90159, GL 91040, KPG 70, and BG 439 were found resistant. Thirteen lines were found to be resistant to moderately resistant. Pande *et al.* (2006) reported that out of the 148 wild accessions evaluated, 29 accessions were found to be resistant. The remaining 107 were categorized as moderately resistant (50), susceptible (51) and highly susceptible (6) to BGM. Rashid *et al.* (2013) studied on the BGM of 34 kabuli chickpea germplasm during three subsequent years of 2008-2009, 2009-2010 and 2010-2011 to screen out the suitable high yielding chickpea varieties under natural epiphytotic condition. Out of 34 germplasm 10 germplasms showed Resistant (R) reaction and 24 lines showed Susceptible (S) reaction to *Botrytis cinerea*.

The tested 23 chickpea germplasms/varieties differed significantly from one to another in respect of growth and yield contributing parameters. Under present study it was found that out of 23 chickpea germplasms/varieties, 4 germplasms/varieties showed semi erect, 15 germplasms/varieties showed semi spreading, 4 germplasms showed spreading and there were no prostrate and erect germplasms.

Table 1. Plant type, plant stand and flower color of chickpea germplasms/varieties under field condition in 2012-2013

Sl. No.	Name of Entry	Plant type	Plant Stand	Flower color
1	BD-5694	SS	Acceptable	Deep purple
2	BD-6036	SS	Acceptable	Pink
3	BD-6040	SS	Good	Purple
4	BD-6041	SE	Acceptable	Grey
5	BD-6042	S	Very good	Purple
6	BD-6044	S	Very good	Grey
7	BD-6045	SS	Good	Purple
8	BD-6046	SS	Good	Deep purple
9	BD-6047	SS	Acceptable	Purple
10	BD-6048	SS	Acceptable	Grey
11	BD-6049	SS	Acceptable	Purple
12	BD-6067	SE	Good	Purple
13	BD-6208	SS	Acceptable	Purple
14	BD-6289	SE	Good	Grey
15	BD-6293	S	Acceptable	Grey
16	BD-6297	SS	Good	Purple
17	BD-6301	SS	Acceptable	Purple
18	BD-6304	SS	Acceptable	Purple
19	BD-6346	S	Good	Purple
20	BD-6350	SS	Acceptable	Pink
21	BD-6352	SS	Good	Purple
22	BARI Chickpea-9	SE	Acceptable	Purple
23	BARI Chickpea-5	SS	Good	Purple

Plant type: E = Erect (0-5^0 from vertical), SE = Semi erect (15-25^0 from vertical), SS = Semi spreading (26-60^0 from vertical), S = Spreading (61-100^0 from vertical), P = Prostrate spreading (100^0 < from vertical)

It was observed that out of 23 chickpea germplasms/varieties, 2 germplasms showed very good performance, 9 germplasms/varieties performed as good, 12 germplasms/varieties performed as acceptable and there were no poor and very poor germplasms/varieties as plant stand. Among the 23 germplasms/varieties of chickpea 2 germplasms showed deep purple color flower, 2 germplasms showed pink color flower, 5 germplasms showed grey color flower and 14 germplasms/varieties showed purple color flower (Table 1). Reddy *et al.* (1993) reported that Chickpea genotypes with erect and compact growth habit had less BGM compared with genotypes with bushy and spreading growth habit. This effect of compact plant type on BGM disease is attributed to the differences in micro-climatic conditions. Rashid *et al.* (2013) studied on the BGM of 34 kabuli chickpea germplasm during three subsequent years of 2008-2009, 2009-2010 and 2010-2011. Among the 34 germplasms/varieties of chickpea 8, 18, 5 and 3 lines showed erect, semi erect, semi spreading and spreading type, respectively. Bakr *et al.* (1997) reported that bushy and dense canopy, resulting from close spacing and spreading type of plants favors the development of BGM, as these conditions resulted high humidity.

Out of tested 23 germplasms/varieties plant height ranged from 29.40 cm to 56.50 cm while the tallest plant was found in check variety BARI Chickpea-9 and the shortest plant was recorded in case of germplasm BD-6346 (Table 2). No. of days require for the maturation ranged from 134.50 to 137 days. The maximum duration for maturity was recorded in germplasm BD-6352 and the minimum duration was recorded in line BD-6036 (Table 2). Number of branch per plant ranged from 2.50 to 10.00. It was found that most of the germplasms/varieties gave three-four primary branches yet only a few lines gave 7.50-10.0 primary branches as in average. The highest number of branch was recorded in BARI Chickpea-9 and the lowest number in germplasm BD-6036 (Table 2). Number of total pods per plant ranged from to 20.55 to 73.96 while the lowest number of pods was recorded in BD-6304 (20.55) and the highest number of pods was recorded in BD-6301 (73.96) (Table 2).

Table 2. Performance of Chickpea germplasm/varieties regarding plant height (cm.), No. of branch/plant, Days to maturity and No. of total pods/plant under field condition in 2012-2013

SL. No.	Name of Entry	Plant height (cm)	No. of branch/ plant	Days to maturity	No. of total pods/plant
1	BD-5694	44.50 c	2.90 f-h	135.5 b-d	51.70 ef
2	BD-6036	32.00 i-j	2.50 h	134.5 d	32.30 j
3	BD-6040	37.30 e-h	3.50 c-g	135.0 cd	46.10 gh
4	BD-6041	34.10 f-j	3.32 d-h	136.0 a-c	42.30 hi
5	BD-6042	33.20 h-j	3.60 c-f	136.5 ab	33.80 j
6	BD-6044	35.20 f-i	2.60 g-h	135.5 b-d	44.20 gh
7	BD-6045	33.70 g-j	4.20 c-d	135.0 cd	46.20 gh
8	BD-6046	37.40 e-h	4.00 c-e	136.0 a-c	51.40 e-f
9	BD-6047	36.10 f-i	3.80 c-f	135.0 cd	60.20 c
10	BD-6048	38.90 d-f	3.50 c-g	135.0 cd	48.40 fg
11	BD-6049	35.00 f-i	4.20 c-d	136.5 ab	38.45 i
12	BD-6067	36.40 e-i	3.90 c-e	135.0 cd	54.10 de
13	BD-6208	43.00 c-d	3.10 e-h	136.0 a-c	71.80 a
14	BD-6289	41.40 c-e	3.60 c-f	136.0 a-c	61.30 c
15	BD-6293	37.50 e-h	3.50 c-g	135.5 b-d	41.90 hi
16	BD-6297	35.65 f-i	3.30 d-h	135.0 cd	38.15 i
17	BD-6301	38.37 d-g	3.53 c-f	135.50 b-d	73.96 a
18	BD-6304	34.17 f-j	3.10 e-h	135.50 b-d	20.55 k
19	BD-6346	29.40 j	3.60 c-f	136.00 a-c	47.90 fg
20	BD-6350	38.70 d-g	4.30 c	136.00 a-c	66.70 b
21	BD-6352	36.60 e-i	3.30 d-h	137.00 a	47.90 fg
22	BARI Chickpea-9	56.50 a	10.00 a	135.70 a-d	58.00 cd
23	BARI Chickpea-5	49.00 b	7.50 b	136.00 a-c	53.00 e
CV (%)		5.51	9.67	0.43	4.03
LSD(0.05)		4.342	0.79	1.22	4.10

Out of tested 23 germplasms/varieties number of seed per pod ranged from 1.00 to 2.00 where lowest number of seed per pod was recorded in BD-6067 (1.00) while highest number of seed (2.00) per pod was recorded in 14 germplasms/varieties (Table 3). In 100-seeds weight ranged from 8.00 g to 24.50 g. The highest 100-seed weight was in BARI Chickpea-9 and the lowest 100-seed weight was in BD-6042 (Table 3). Yield performance data of 23 germplasms/varieties ranged from 340.00 kg/ha to 1660.00 kg/ha. The maximum yield was recorded in BD-6352 followed by BARI Chickpea-9 and the minimum yield was recorded in BD-6036 and BD-6041 (Table 3).

Table 3. Performance of Chickpea germplasm/varieties regarding no. of seeds/pod, 100-seeds wt. (g) and yield (kg/ha) under field condition in 2012-2013

SL. No.	Name of Entry	No. of seeds/pod	100-seeds wt. (g)	Yield (kg/ha)
1	BD-5694	2.00 a	9.00 ij	820.0 g
2	BD-6036	2.00 a	11.10 f-h	340.0 l
3	BD-6040	2.00 a	9.80 hi	420.0 kl
4	BD-6041	1.90 a	10.65 g-i	340.0 l
5	BD-6042	1.50 ab	8.00 j	485.0 jk
6	BD-6044	2.00 a	11.00 g-h	510.0 ij
7	BD-6045	2.00 a	12.30 d-g	495.0 i-k
8	BD-6046	2.00 a	9.00 ij	570.0 i
9	BD-6047	2.00 a	10.95 gh	720.0 h
10	BD-6048	1.50 ab	10.20 hi	730.0 h
11	BD-6049	2.00 a	9.80 hi	415.0 kl
12	BD-6067	1.00 b	12.20 d-g	940.0 f
13	BD-6208	2.00 a	10.15 hi	1365.0 c
14	BD-6289	2.00 a	12.80 d-f	1165.0 e
15	BD-6293	1.90 a	13.65 de	1265.0 d
16	BD-6297	1.50 ab	11.45 f-h	670.0 h
17	BD-6301	2.00 a	13.95 d	480.0 jk
18	BD-6304	1.70 a	17.80 b	1460.0 b
19	BD-6346	1.80 a	13.30 de	730.0 h
20	BD-6350	2.00 a	10.90 gh	1230.0 de
21	BD-6352	1.80 a	12.10 e-g	1660. a
22	BARI Chickpea-9	2.00 a	24.50 a	1600. a
23	BARI Chickpea-5	2.00 a	16.00 c	935.0 f
CV (%)		13.4	6.17	4.30
LSD (0.05)		0.516	1.56	75.02

The findings of the study has been supported by Pande *et al.* (2006), Hossain *et al.* (1997); Bakr *et al.* (1997); Butler (1993); Kayan and Adak (2004); Rashid *et al.* (2013) who reported that the chickpea line differed significantly in respect of agronomic traits and yield parameters.

CONCLUSION

Based on the findings of the present study it can be concluded that 22 germplasms/varieties were found resistant to BGM and the germplasm BD-6352 produced higher yield. So this germplasm may be tested for different agro-ecological zones for further conformation and other 20 germplasms can be used as resistant genetic material for further study in genetic engineering to create new germplasms/varieties by transferring the resistant gene in high yielding local susceptible varieties.

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