Yield Loss Assessment Of Chickpea Caused By Botrytis Gray Mold Through Fungicide (Bavistin) Spray

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Abstract: An experiment was conducted to assess the yield loss of chickpea caused by Botrytis gray mold (BGM) through fungicide spray at Pulses Research Centre, Bangladesh Agricultural Research Institute, Ishurdi, Pabna, Bangladesh. Sixteen entries were evaluated following RCB design with three replications. Out of 16 tested germplasms, eight germplasms (92040*52, FLIP97-530 CLIMS, 94-012*98V4006, FLIP98-106C, Gully, FLIP94-509C, 97020-1489 and S95425) showed resistant reaction, while eight and one entries showed susceptible and highly susceptible, respectably, in fungicide sprayed plot. The highest yield increase over BGM inoculated plot were observed in BARWON*98CIH4007 (180.49%) and 97020-1489 (157.96%). The lowest yield increase over BGM inoculated plot were recorded in HEERA*98CZH4010 (6.39%) and 94-012*98V4006 (8.93%) genotypes.
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Introduction

Chickpea (*Cicer arietium* L.) is the second most important pulse crop in the world and six major pulse crops in Bangladesh. It is believed that disease contribute heavily towards decline in production. About 172 diseases are reported to attack chickpea world wide, but only 17 diseases infest chickpea crop in Bangladesh. Among these, Botrytis gray mold (BGM) caused by *Botrytis cinerea* Pers. Ex. Fr. is the most damaging disease in chickpea and has both regional and international perspective. It is an economically important disease in areas with cool, cloudy and humid weather (Pande *et al*., 2006a). The crop encounters frequent BGM epidemics with near complete yield loss in the Indian Subcontinent accounting for 80% of the global chickpea area. Frequent BGM epidemics in North Indian states have been one of the reasons for a geographical shift of chickpea cultivation to southern states, (Ali and Kumar, 2009). In Nepal, the recurring problem of BGM has caused a drastic reduction in chickpea area from 28,190 ha in 1990 to less than 9,000 ha in 2010. In Bangladesh, a conservative estimate of crop loss due to BGM ranges 10-15% under normal conditions but can reach up to 80% or more under periods of high disease pressure (Bakr and Ahmed, 1992; Johansen *et al*., 2008). Therefore, chickpea cultivation has declined sharply from 102,867 ha in 1990 to 18,219 ha in 2000 (Bakr *et al*., 2002), and further reduced to 7,224 ha in recent years. Yield losses due to BGM have also been reported from other chickpea growing countries including Australia, Argentina, Canada, Columbia, Hungary, Mexico, Myanmar, Spain, Turkey, the USA and Vietnam (Nene *et al*., 1996; Pande *et al*., 2006a). Due to this disease problem farmers are loosing their interest to grow chickpea. BGM is difficult to manage as the causal pathogen is soil, seed and air borne and unfortunately, non-chemical methods for its control are difficult and ineffective. Extensive screening of chickpea germplasm against BGM did not identify a genotype with a high level of resistance (Haware and Nene, 1982; Singh *et al*., 1982; Chaubey *et al*., 1983; Rathi *et al*., 1984; Ahmad, 1989; Dewan 1993; Bakr *et al*., 2002; Pande *et al*., 2006b). It is very difficult to manage the disease through a single management option. But it is suggested that integration of some management option could be effective against the disease. However, thorough study on prevalence and damage of chickpea due to BGM has not yet been studied in Bangladesh. For the last two decays it appeared in epidemic form. Considering the importance of the above background, the present research programme was designed to achieve the following objectives: To find out the yield loss assessment of chickpea caused by Botrytis gray mold.

Materials and Methods

Sixteen entries of chickpea were evaluated under this trial. The experiment was conducted following Randomized Complete Block Design with three replications. Fungicide (Bavistin@0.1%) was sprayed.

A Botrytis gray mold (BGM) susceptible variety 'Nabin' was used as check. The entries were sown on November 21, 2008 in 2 m long single row plot allowing 50 cm x 10 cm spacing. The seeds were treated with suitable rhizobium strain to ensure nodulation. Germination, plant stand and crop growth was normal. Bavistin was sprayed at 3 weeks after emergence. Subsequent applications were done at 14 days interval until first flower. From first flowering, fungicide was applied at 7 days interval until maturity. Application of mist irrigation was initiated after 75 days of sowing. Mist irrigation was applied each time for 30 minutes, 5 times a day with an interval of 2 hours starting from 10 am to ensure high humidity for disease development. Plant debris and BGM inoculum ($1x10^5$ conidia/ml) were applied in this nursery at the flowering stage. Data on disease score was recorded three times with a 1-9 disease scoring scale where, 1= No disease and 9 = Lesions very common on all plants; stem girdling on more than 50% plants; death of most plants; damage more than 75% (Singh, 1999). Data on disease severity of BGM (1-9 scale) and grain yield were recorded. Other intercultural operation like mulching, weeding were done as and when necessary. Insecticide 'Decis' (0.02%) was applied for controlling pod borer of chickpea. Data were analyzed statically following Duncan's Multiple Range Test according to Gomez and Gomez (1984).

Results and Discussion

Assessment of yield loss caused by BGM in Chickpea genotypes under inoculated condition during 2008-09 are presented in Table 1. The disease severity varied significantly among the genotypes of chickpea. Out of 16 tested germplasms, 14 germplasms showed susceptible and three germplasms showed highly susceptible reaction in BGM inoculated plot. But in fungicide sprayed plot, eight germplasms (92040*52, FLIP97-530 CLIMS, 94-012*98V4006, FLIP98-106C, Gully, FLIP94-509C, 97020-1489 and S95425) showed resistant reaction, while 8 and 1 entries showed susceptible and highly susceptible, respectively. These findings corroborate with the findings of other researchers. Singh *et al*. (1997) screened 2550 chickpea lines 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*. (2006b) 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*.

Table 1. Disease severity of 16 Chickpea entries due to BGM infection under mist condition

Sl. No.	Name of the Entry	Disease severity of BGM (1-9 scale)			
		BGM inoculation	Disease reaction	Fungicide spray	Disease reaction
1.	92040*52	7	S	5	R
2.	Amethyst-1-17RS3 (~Rupali)	7	S	6	S
3.	FLIP97-530 CLIMS	6	S	5	R
4.	98170-3001	7	S	6	S
5.	94-012*98V4006	6	S	5	R
6.	FLIP97-503 CLIMS	7	S	6	S
7.	WACPE2078	7	S	6	S
8.	FLIP98-106C	7	S	5	R
9.	Gully	7	S	5	R
10.	Flip94-509C	6	S	5	R
11.	BARWON*98CIH4007	7	S	6	S
12.	97020-1489	7	S	5	R
13.	S95425	7	S	5	R
14.	Howzat	8	HS	7	S
15.	ICCV96836 (Genesis 836)	8	HS	6	S
16.	HEERA*98CZH4010	7	S	6	S
17.	Susceptible check (Nabin)	9	HS	8	HS

R = Resistant, S = Susceptible, HS = Highly Susceptible

The percentage of yield loss due to BGM infection at different germplasm of chickpea was computed and presented in Table 2. The highest yield increase over BGM inoculated plot were observed in BARWON*98CIH4007 (180.49%) and 97020-1489 (157.96%). The lowest yield increase over BGM inoculated plot were recorded in HEERA*98CZH4010 (6.39 %,) and 94-012*98V4006 (8.93%) genotypes (Table 2). Percent yield loss due to fungicide sprayed and BGM inoculation were calculated in table 2. Highest yield loss was found in BARWON*98CIH4007 (64.35%) followed by 97020-1489 (61.23%) and lowest yield loss was observed in HEERA*98CZH4010 (6.01%) followed by 94-012*98V4006 (8.20%). The findings of the study has been supported by Pande *et al.* (2006a), Hossain *et al.* (1997); Bakr, *et al.* (1997); Butler (1993); Kayan and Adak (2004); Yucel and Anlarsal (2013); Rashid *et al.* (2013) who reported that the chickpea line differed significantly in respect of agronomic traits and yield parameters.

Table 2. Yield increased over BGM infection under mist condition

Sl. No.	Name of the Entry	Yield of BGM inoculated plot (kg/ha)	Yield of fungicide sprayed plot (kg/ha)	% yield increase over BGM inoculated plot	% yield losses due to BGM inoculation
1.	92040*52	526.67	757.50	43.83	30.47
2.	Amethyst-1-17RS3 (~Rupali)	470.00	850.00	80.85	44.71
3.	FLIP97-530 CLIMS	508.33	620.00	21.97	18.01
4.	98170-3001	566.67	642.50	13.38	11.80
5.	94-012*98V4006	700.00	762.50	8.93	8.20
6.	FLIP97-503 CLIMS	463.33	550.00	18.71	15.76
7.	WACPE2078	350.00	455.00	30.00	23.08
8.	FLIP98-106C	336.67	470.00	39.60	28.37
9.	Gully	421.67	500.00	18.58	15.67
10.	Flip94-509C	550.00	800.00	45.45	31.25
11.	BARWON*98CIH4007	166.67	467.50	180.49	64.35
12.	97020-1489	261.67	675.00	157.96	61.23
13.	S95425	241.67	370.00	53.10	34.68
14.	Howzat	283.33	462.50	63.24	38.74
15.	ICCV96836 (Genesis 836)	650.00	790.00	21.54	17.72
16.	HEERA*98CZH4010	900.00	957.50	6.39	6.01

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