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EFFICACY OF FUNGICIDES IN CONTROLLING BOTRYTIS GRAY MOLD OF CHICKPEA (*Cicer arietinum* L.)

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Abstract

A field experiment was carried out at Regional Pulses Research Station (RPRS), Madaripur during Rabi season of 2011-12 and 2012-13 to evaluate the most effective fungicides in controlling Botrytis Gray Mold (BGM) of Chickpea. Five different fungicides e.g. Propiconazole (Tilt 250 EC), Carbendazim (Bavistin DF), Fenamidone+Mancozeb (Secure 600 WG), Difenoconazole (Score 250 EC), Tebuconazole (Folicure 250 EC) were evaluated under natural condition. Results revealed that among the five fungicides Fenamidone+Mancozeb (Secure 600WG) sprayed at the rate of 1g/L with 7 days interval gave the lowest BGM score of 3.80 and 4.00 in 1-9 scale during 2011-12 and 2012-13 and produced highest yield of 1547 and 1443 kg/ha, respectively. Besides, the highest BGM was scored by the untreated control plot (6.26 and 6.33) and produced the lowest yield of 988 and 853 kg/ha during the two consecutive years.

Introduction

Chickpea (*Cicer arietinum* L.) is the third most important pulse crop in the world and seven most important pulse crops in Bangladesh as per production. Botrytis gray mold (BGM) caused by *Botrytis ceneria* is an important disease of chickpea in northern India, Nepal, Bangladesh and Pakistan. It was first reported in India in 1915 (Shaw and Ajrekar, 1915). Outside the Indian subcontinent the disease has been reported from Argentina (Carranza, 1965), Australia (Nene *et al.*, 1989), Canada (Kharbanda and Bernier, 1979), and Chile (Sepulveda and Alvarez, 1984). It was first documented in 1981 in Bangladesh (Annon., 1981). In Bangladesh, for high infestation of BGM, farmers are reluctant to grow chickpea that results declining of area and production of the crop. The pathogen of the disease is soil, seed and air borne. Different researchers had been taking many efforts to control the disease. Foliar application of fungicides is one of the most important management options to control the disease. Therefore, the experiment has been conducted to find out suitable fungicide to control BGM of chickpea.

Materials and Method

The experiment was conducted at Regional Pulses Research Station (RPRS), Madaripur, Bangladesh during Rabi season of 2011-12 and 2012-13. The experiment was laid out in Randomized Complete Block Design (RCBD) with

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three replications. The five fungicides viz- Propiconazole (Tilt 250 EC, 0.5 ml/L), Carbendazim (Bavistin DF, 2.0 g/L), Fenamidone+Mancozeb (Secure 600 WG, 1 g/L), Difenoconazole (Score 250 EC, 0.5 ml/L), Tebuconazole (Folicure 250EC, 2.0 ml/L) and untreated control were included in the study. The unit plot size was 2.4m × 3m and plant spacing was 50 cm × 10 cm. The seeds of BGM susceptible chickpea variety BARI Chola-1 (Nabin) was treated with Provax-200 to control fusarium wilt and sown on 16 November 2011 and 14 November 2012. Intercultural operations were done manually and herbicides application (Rahman and Miah, 1989). The experiment was monitored regularly to observe the first appearance of BGM. Spraying of fungicides was started when the disease appeared on the crop. Four sprays were applied at weekly interval on 8, 15, 22 and 27 February, 2012 and 3, 10, 17 and 24 February, 2013 respectively by the knapsack sprayer. Data on BGM disease was recorded on three frequencies (18, 25 and 30 February, 2012 and 13, 20 and 27 February, 2013). BGM of chickpea was graded on a 1-9 scoring scale (Singh, 1999). The scale described as 1= no infection on any part of the plant, 2= minute lesions on lower leaves, flowers and pods covered under dense plant canopy, usually not visible, 3= lesions on less than 5% of the leaves, flowers and pods covered and under dense plant canopy, 4= lesions and some fungal growth (conidiophores and conidia) can be seen on up to 15% of the leaves, flowers and pods and branches covered under dense plant canopy, 5= lesions and slight fungal growth on up to 25% of the leaves, flowers and pods, stems and brunches covered under dense plant canopy, 6= lesions and fungal growth on up to 40% of the leaves, flowers and pods, stems and branches defoliation, 25% of the plant killed, 7= large lesions and good fungal growth on up to 60% of the leaves, flowers and pods, stems and branches defoliation common, drying of branches and 50% of the plants killed, 8= large lesions and profuse fungal growth on up to 80% of the leaves, flowers and pods, stems and branches, severe defoliation, drying of branches and 75% of the plants killed, 9= large lesions, very profuse fungal growth on up to 100% of the flowers, pods, stems, branches, almost complete defoliation, drying of plants and 100% of the plants killed. The crop was harvested on 15 March 2012 and 18 March 2013 at matured stage. Data on yield contributing characters recorded from 10 randomly selected plants from each plot. Grain yield (kg/ha) were recorded from the whole plot. The Data were analyzed statistically through MSTAT-C.

Results and Discussion

The fungicides caused sharp variation in percent mortality and severity of botrytis gray mold disease of chickpea in Madaripur during 2011-12 (Table 1). Maximum percent mortality (15.35) was observed in Tebuconazole (Folicur 250EC) treated plot and minimum (7.65) in Difenoconazole (Score 250EC)

treated plot. The BGM disease score was found minimum (3.80) in Fenamidone+Mancozeb (Secure 600 WG) treated plot and maximum (6.26) in control plot. The grain yield and yield contributing characters of chickpea were significantly influenced by the test fungicides during 2011-12 cropping season (Table 2). The highest number of branches (4.25) were recorded from Propiconazole (Tilt 250 EC), Fenamidone+Mancozeb (Secure 600 WG) and Tebuconazole (Folicur 250EC) treated plots and lowest (3.20) from Difenoconazole (Score 250 EC) treated plot. Similarly, the highest plant height (45.00cm) was recorded from Difenoconazole (Score 250 EC) treated plot and lowest (33.33 cm) from Tebuconazole (Folicur 250 EC) treated plot. There was no significant differences in pods/plant and seeds/pod due to the application of fungicides in chickpea. However, higher number of pods/plant was observed in case of fungicide treatment over untreated control plot. In case of seeds/pod, Fenamidone+Mancozeb (Secure 600 WG) treated plot produced maximum (1.78) while control plot produced lowest (1.53) seeds/pod. The effect of fungicide was statistically similar in respect of 100 seed weight but differed from the untreated control plot. The 100 seed weight ranged from 11.5-13.0 g among the fungicide treated plot and maximum (13.0 g) was in Fenamidone+Mancozeb (Secure 600 WG) treated plot and minimum (8.9 g) in control plot. Among the five fungicides Fenamidone+Mancozeb (Secure 600 WG) sprayed plot produced highest seed yield (1547 kg/ha) which was statistically similar to that of Propiconazole (Tilt 250 EC) and Difenoconazole (Score 250EC) while the lowest (988 kg/ha) yield was recorded in control plot (Table 2).

Table 1. Efficacy of different fungicides in controlling BGM of chickpea during 2011-12 at Madaripur.

Fungicides	Mortality (%)	BGM Scale (1-9)
Propiconazole (Tilt 250 EC)	9.45	4.73
Carbendazim (Bavistin DF)	8.36	4.76
Fenamidone+Mancozeb (Secure 600 WG)	9.82	3.80
Difenoconazole (Score 250 EC)	7.65	5.00
Tebuconazole (Folicur 250 EC)	15.35	5.33
Control	11.46	6.26
CV(%)	8.85	5.96
LSD (0.05)	5.80	0.53

Values within a column having same letter(s) do not differ significantly (p=0.05); BGM=Botrytis gray mould.

Table 2. Effect of different fungicides on the yield and yield contributing characters of chickpea through suppression of BGM during 2011-12 at Madaripur.

Fungicides	Branch per plant	Plant height (cm)	Pods per plant	Seeds per pod	100 seed weight (gm)	Yield (kg/ha)
Propiconazole (Tilt 250 EC)	4.25 a	41.33 b	47.53	1.73	12.0a	1514 ab
Carbendazim (Bavistin DF)	3.66 a	42.20 ab	41.80	1.33	12.5 a	1433 b
Fenamidone+Mancozeb (Secure 600 WG)	4.25 a	36.80 c	47.93	1.78	13.0 a	1547 a
Difenoconazole (Score 250 EC)	3.20 b	45.00 a	42.67	1.66	12.2 a	1492 ab
Tebuconazole (Folicur 250 EC)	4.25 a	33.33 c	46.33	1.56	11.5 a	1106 c
Control	3.80 a	36.80 c	38.53	1.53	8.9 b	988 d
CV(%)	7.71	10.32	11.13	12.41	8.05	4.07
LSD (0.05)	1.56	6.883	10.18	0.65	43.30	96.35

Values within a column having same letter(s) do not differ significantly (p=0.05).

Percent mortality and botrytis gray mould of chickpea varied among the fungicide treated plots during 2012-13 (Table 3). The mortality (%) was highest (14.63) in Tebuconazole (Folicur 250 EC) treated plot and lowest (7.80) in Propiconazole (Tilt 250 EC) treated plot. The BGM score was lowest (3.00) in Fenamidone+Mancozeb (Secure 600 WG) sprayed plot and where the maximum (6.33) disease severity was found in control plot. Yield and yield contributing characters of chickpea were significantly influenced by the application of fungicides during 2012-13 (Table 4). The number of branches per plant varied from 3.03 to 3.36 and plant height from 31.10 cm to 39.30 cm. The maximum number of branches (3.36) were recorded from Propiconazole (Tilt 250 EC) and maximum height (39.30 cm) was recorded from Carbendazim (Bavistin DF) treated plot. The highest no. of pods/plant (39.17) was observed in Fenamidone+Mancozeb (Secure 600 WG) sprayed plot and lowest (33.63) in control plot. Incase of seeds/pod, Fenamidone+Mancozeb (Secure 600 WG) treated plot produce maximum (1.33) and control plot produced minimum (1.00) number of seeds/pod. The maximum 100 seed weight (12.02 g) was recorded from Fenamidone+Mancozeb (Secure 600 WG) and minimum (10.30 g) from control plot. Among the fungicides Fenamidone+Mancozeb (Secure 600 WG) sprayed plot produced highest seed yield (1443 kg/ha) followed by Propiconazole (Tilt 250EC) and Tebuconazole (Folicur 250EC) with 1370 kg/ha and 1317 kg/ha respectively. The lowest seed yield (853 kg/ha) was produced by control plot (Table 4).

Table 3. Efficacy of fungicides in controlling BGM of chickpea during 2012-13 at Madaripur.

Fungicides	Mortality (%)	BGM scale (1-9)
Propiconazole (Tilt 250 EC)	7.80	3.67
Carbendazim (Bavistin DF)	13.17	4.33
Fenamidone+Mancozeb (Secure 600 WG)	8.34	3.00
Difenoconazole (Score 250 EC)	8.20	3.33
Tebuconazole (Folicur 250 EC)	14.63	5.67
Control	9.53	6.33
CV(%)	7.57	13.34
LSD (0.05)	1.33	0.99

Values within a column having same letter(s) do not differ significantly (p=0.05).

Table 4. Effect of different fungicides on the yield and yield contributing characters of chickpea through suppression of BGM during 2012-13 at Madaripur.

Fungicides	No. of branches /plant	Plant height (cm)	No. of pods/ plant	No. of seeds/ pod	100 seed wt. (g)	Yield (kg/ha)
Propiconazole (Tilt 250 EC)	3.36a	38.37a	38.10a	1.23 ab	12.00 a	1370 ab
Carbendazim (Bavistin DF)	3.23ac	39.30a	37.67a	1.23 ab	11.63 a	1175 bc
Fenamidone+Mancozeb (Secure 600 WG)	3.33ab	38.90a	39.17a	1.33 a	12.02 a	1443 a
Difenoconazole (Score 250 EC)	3.03d	38.47a	38.17a	1.27 a	11.83 a	1048 cd
Tebuconazole (Folicur 250 EC)	3.13cd	31.10c	33.77b	1.07 c	10.83 b	1317 ab
Control	3.33ab	33.30b	33.63b	1.00 c	10.30 b	853 e
CV(%)	2.91	2.43	2.72	6.40	3.62	8.79
LSD (0.05)	0.16	1.55	1.74	0.13	0.72	73.6

Values within a column having same letter(s) do not differ significantly (p=0.05).

Management of plant diseases successfully achieved through application of chemical fungicides. All the tested fungicides reduced the disease score and enhanced plant growth parameters and yield of chickpea in comparison with control plot. The lowest BGM disease score of 3.80 and 3.00 were recorded from the plots sprayed with Fenamidone+Mancozeb (Secure 600 WG) and the highest score of 6.26 and 6.33 were recorded from control plot during 2011-12 and 2012-13, respectively. In 2012-13, the yield of chickpea was less than that of 2011-12 due to attack of pod borer (*Helicoverpa armigera* Hubner). This results in less number of seed/pod in 2012-13. But the BGM infection was comparatively less in the second year due to unfavorable climatic conditions for BGM results in low scoring scale. However, foliar sprays, used at regular intervals with the first appearance of the disease, can control an epidemic in the crop (Pande *et al*., 2002), particularly when used in combination with a seed-dressing fungicide (Grewal and Laha, 1983). Effective fungicides used as a foliar spray 50 days after sowing or with the first sign of the disease include Captan, Carbendazim, Chlorothalonil, Mancozeb, Thiabendazole, Thiophanate-methyl, Thiram, Triadimefon, Triadimenol, or Vinclozolin (Singh and Kaur, 1990; Haware and McDonald, 1992; Bakr *et al*., 1993; Haware, 1998; Knights and Siddique, 2002; Pande *et al*., 2002; Davidson *et al*., 2004). Sometimes multiple sprays are recommended, although generally one spray at flowering followed by another 10 days later on a moderately resistant chickpea cultivar provides the best protection against BGM on chickpea (Pande *et al*., 2002).

Conclusion

Fenamidone+Mancozeb (Secure 600 WG) at 1 g/L water effectively controlled the BGM disease and produced higher yield of chickpea through four sprays at 7 days interval if applied at the first appearance of the disease.

References

Annonymous. 1981. Annual Report of the Regional Agricultural Research Station, Ishwrdi, Bangladesh, 1980-81. Pp. 66.

Bakr, M. A., M. M. Rahman, F. Ahmed and J. Kumar. 1993. Progress in management of botrytis gray mold of chickpea in Bangladesh. In 'Recent advances in research in botrytis gray mold of chickpea'. (Eds M, P. Haware, C. L. L. Gowda, D. McDonald) pp. 17–19. (ICRISAT: Patancheru, AP, India)

Carranza, J. M. 1965. [Wilt of chickpea (*C. arietinum)* caused by *B. cinerea.*] (In Es.). Revta Fac. Agron. Univ. Nac. La Plata. **41**:135-138.

Davidson, J. A., S. Pande, T. W. Bretag, K. D. Lindbeck and G. K. Kishore. 2004. Biology and management of *Botrytis* spp. in legume crops. In 'Botrytis: biology, pathology and control'. (Eds Y. Elad, B. Williamson, P. Tudzynski, N. Delen) pp. 295–318. (Kluwer Academic Publishers: The Netherlands)

Grewal, J. S. and S. K. Laha. 1983. Chemical control of botrytis blight of chickpea. *Indian J. Phytopath.* **36**: 516–520.

Haware, M. P. 1998. Diseases of chickpea. In 'The pathology of food and pasture legumes'. (Eds D. J. Allen and J. M. Lenne) Pp. 473–516. (ICARDA, CAB International: Wallingford, UK)

Haware, M. P. and D. McDonald. 1992. Integrated management of botrytis gray mold of chickpea. In 'Botrytis gray mold of chickpea'. (Eds M. P. Haware, D. G. Faris and C. L. L. Gowda.) Pp. 3–6. (ICRISAT: Patancheru, AP, India)

Kharbanda, P. D. and C. C. Bernier. 1979. Botrytis gray mold of chickpea in Mani toba. Plant Disease Reporter **63(8)**: 662-663.

Knights, E. J. and K. H. M. Siddique. 2002. Manifestation of *Botrytis cinerea* on chickpeas in Australia. In 'Workshop Proceedings Integrated Management of Botrytis Grey Mould of Chickpea in Bangladesh and Australia'. Pp. 70–77. (Bangladesh Agricultural Research Institute: Joydebpur, Gazipur, Bangladesh)

Nene, Y. L., V. K. Sheila and S. B. Sharma. 1989. A world list of chickpea *(Cicer arietinum* L.) and pigeonpea *(Cajanus cajan* L Mill sp.) pathogens. Pulse Pathology Progress Report No. 32. Patancheru, A.P. 502 324, India: International Crops Research Institute for the Semi-Arid Tropics. Pp. 19.

Pande, S., G. Singh, J. N. Rao, M. A. Bakr, P. C. P. Chaurasia, S. Joshi, C. Johansen, S. D. Singh, J. Kumar, M. M. Rahman, and C. L. L. Gowda. 2002. Integrated management of botrytis gray mold of chickpea. Information Bulletin No. 61, ICRISAT, Andhra Pradesh, India.

Rahman, M. A. and A. A. Miah. 1989. Study on seedling mortality and plant competition of lentil at a wide range of population densities. Research Report on Pulse Agronomy. Pulse Research Center. BARI, Joydebpur, Gazipur. P. 27-33

Sepulveda, R. P. and A. M. Alvarez. 1984. Identification of *Botrytis cinerea* Pers. causing blight in chickpea *(Cicer arietinum* L.) (In Es.) Agricultural Technica. **44**:79-80.

Shaw, F. J. F. and S. L. Ajrekar. 1915. The genus *Rhizoctonia* in India. Botanical Series 7:77. Memoirs of Department of Agriculture, New Delhi, India.

Singh, G. 1999. Proposed rating scale for BGM of chickpea. BGM Newsletter **2(1)**: 5-6

Singh, G. and L. Kaur. 1990. Chemical control of gray mold of chickpea. Plant Dis. Res. **5**: 132–137.