MANAGEMENT OF POWDERY MILDEW IN SWEET GOURD (*Cucurbita moschata*)

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ABSTRACT

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The experiment was conducted at Horticulture Research Centre (HRC), Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur during Rabi 2003- 2006 following RCB design with 4 replications. Sixty two germplasm of sweet gourd and eight fungicides were evaluated against powdery mildew caused by *Erysiphe cichocearum* under field condition. Four lines of sweet gourd namely BD 4388, BD 204, BD 205, BD 210 were found resistant to powdery mildew. Mycosulf, Thiovit and Insuf were found best in controlling severity of disease by >80% not depending on locations. Additional yield 14.58t/ha was found from Thiovit treated plot which was 65.35% higher compared to control. Net income increased almost two times and the farmers having more options for controlling powdery mildew as more than one fungicide were found effective.

Key words: Sweet gourd, evaluation**,** *Erysiphe cichocearum*, fungicide, yield loss

INTRODUCTION

Sweet-gourd (*Cucurbita moschata Duchesne*) is one of the vitamin A rich year round vegetables and also important source of income for farmers in Bangladesh. Fungi, virus and nematodes are found major constrains of its production. Powdery Mildew (PM), a fugal disease caused by *Erysiphe cichocearum* is considered a threat for yield reducing factor of the crop (Talukdar, 1974). The pathogen can attack most of the cucurbitaceous crops but its special destructive nature was observed on sweet gourd. Wild species of cucumber were screened against PM and the reaction was found susceptible to resistant to PM (Lebeda, 1984). Due to air borne nature of spores, once the leaves are infected with PM it is difficult to control; it can spread rapidly and become devastating to the crop. After infection it hampers normal growth and development of the host. Plants infected with mildew initially develop white, powdery spots or blotches on the lower and upper leaf surface. Severely infected crop was found to fail to set fruits. Yield loss increased with the increase of disease severity of the crops (Ghoil *et. al* 1988, Khosla *et. al*. 1988, Bhatia and Thakur 1989, Singh *et. al.*1991). Maximum infection is noticed during February to March when suitable temperature about 26°C to 28°C (Singh, 1985) whereas initial infection was found to occur in December. An early heavy infection with mildew had about 30% loss of production compared to a later, higher infection. PM generally causes 10-15% yield loss in different crops. In sweet gourd, PM is the most common disease and can result in yield losses exceeding 30% in the crop (Tisserat, 2006). The disease is most damaging if it appears three to four weeks before harvest (John Smith, 2006). The disease could be prevented and effectively controlled by early application of fungicides like Karathane (Singh and Yadav, 1985; Waraitch *et*. *al*., 1975), Thiovit, Bavistin and Karathane (Jain and Srivastava, 1977), had been recommended. The aims of the present study were to search resistant variety against powdery mildew and to find out effective control measures against the disease.

MATREIALS AND METHODS

The screening experiments were conducted in three consecutive years during Rabi 2003- 2006 at Horticulture Research Centre (HRC), Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur for searching resistant germplasm against *E*. *cichocearum*. Sixty two germplasm were used in this experiment during three years which collected from Gene Bank, BARI, Joydebpur, Gazipur. The seedlings were raised in poly bag in November and transplanted in field in December following RCB design with 4 replications. The field was fertilized with recommended dose of fertilizers (Rashid, 2007), well ploughed with good tilth and the land was fertilized with cowdung, Urea, TSP, MP, Gypsum and Zinc @ 20000, 175, 175, 150, 100 and 12 kg/ha, respectively. The total amount of cow dung, TSP, Gypsum and Zinc and 1/3rd of urea and MP were applied during final land preparation. The rest of urea and MP were applied in four equal installments at 21, 35, 55, and 75 days after transplanting. The seedlings were transplanted in the field with the spacing 2m x 3m and MP @ 27gm /pits was top dressed at 10 days after transplanting. Irrigation and inter culture operation was maintained properly. The plant was artificially inoculated with powdery spores of bottle gourd at the growing stage of the crop during dusk. Disease incidence was recorded 30 days after inoculation following 0-5 modified scale according to Lebeda (1984), where 0 = No disease- Immune (I); 1= 1-20% area infected- Resistant (R); 2= 21-40% area infected- moderately resistant (MR); 3 = 41-60% area infected- Moderately susceptible (MS); 4 = 61-80% area infected- susceptible (S); 5 = <80% area infected- Highly susceptible (HS).

A separate experiment was conducted to find out effective fungicides to control PM using a highly susceptible sweet gourd line BD-211(Anon, 2004) during 2004-2005 cropping season. The experiment was conducted in two location namely at BARI, Gazipur and Agricultural Research Station (ARS), Thakurgaon. Eight fungicides were used viz. Mycosulf 80 WP (0.2%), Censor MZ 72 (0.25%), Insuf 80 WP (0.3%), Sulphochem 80 WP (0.25%), Carbozim (0.1%), Haydazim (0.2%) %), Bendazim (0.1%) Thiovit (0.2%) and a control (spray plain water). Three sprays were applied at 15 days interval. Intercultural operation and fertilization was done as before. Assessment of disease severity for PM was recorded seven days after the last spray and the percentage disease index was calculated by Khrishna Prasad *et al*., (1979) as follows:

$$PDI = \frac{\text{Class rating x Class frequency}}{\text{Total number of leaves graded x Maximum rating scale}} \text{ X } 100$$

Yield loss assessment was calculated in a additional experiment using the susceptible line BD-211 during 2006-07 cropping season following pair plot design having twelve replications. Thiovit (0.2%) was sprayed in treated plot whereas plain water in the untreated control. Yield data and the disease severity were recorded. Benefit cost ratio was computed only for Gazipur location on the basis of information for the cost of cultivation given by Economics Section, HRC; and farm price of the product were projected during experimentation and treatment cost during experiment (Table 4). All data were analyzed.

RESULT AND DISCUSSION

Screening of germplasm resistance to E. cichocearum

The plants were infected at 10-15 days after inoculation. The disease severity was recorded at 45 days after inoculation when the fruits reach to maturity (Table 1). It was found that out of 62 accessions 4 lines viz. BD 4388, BD 204, BD 205, BD 210 were showed resistant reaction, 33 lines were moderately resistant, 23 accessions were moderately susceptible and 2 lines were susceptible to their reaction.

Efficacy of fungicides in controlling powdery mildew

All the seven fungicides significantly reduced the PDI value in two locations over control (Table 2). Among the treatments, Mycosulf 80 WP was found best followed by Thiovit and Insuf 80 WP. In both locations, effectiveness of the fungicides belonging Sulpher, Carbendazim and Metalaxyl groups showed similar trend in controlling powdery mildew of sweet gourd.

Summarizing the result, it may be concluded that the applied fungicides could reduce the powdery mildew severity by <80% not depending on locations, whereas >94% PDI value was obtained in the control for both locations.

Based on field trials conducted at different locations it was found that fungicides Mycosulf, Insuf 80 WP, Sulfochem and Thiovit belongs to Sulpher group effectively controlled powdery mildew of sweet gourd. Thiovit (Sulpher), Bavistin (Carbendazim) and Karathane were effective in controlling powdery mildew of pumkin (Jain and Srivastava, 1977)

Assessment of yield loss and cost benefit study

The *Erysiphe cichocearum* is an obligate pathogen and obtain its nutrition from infected hosts. So, the affected plants become weak and unable to produce enough flowers and fruits. The diseased plants produced smaller fruits with less number as a result total weight was lower compared to plants those received different fungicides. As a result, the loss of yield due to PM was estimated 14.58 t/ha in the present study under Gazipur condition that was comprised 65.35% higher yield compared to control (Table 3). Results showed that yield loss 14.58 t/ha could be checked using effective fungicides. The results of the present study is supported by John Smith (2006) who reported that the disease severity for powdery mildew in pumpkin in the control plot was 96.08 where as it was only 65.35 in the sprayed plot and subsequent yield loss was exceeded 30%.

The economics of the effective fungicide application is shown in Table 4. Result revealed that the fungicide Thiovit distinctly controlled the disease and increased yield 65.35% as a result cost benefit ratio was estimated 1.77.

However based on the experimental data, the resistant germplasm could be used for developing disease resistant variety by the breeders. In addition, the effectiveness of the chemicals, additional yield, net profit/ha and benefit cost ratio, three sprays of Thiovit or other fungicides belonging to Sulpher at an interval of 15 days may be recommended for adoption by the pumpkin growers.

Table 1. Reaction of sweet gourd lines against powdery mildew during 2003-2006

Sl. No.	Accession	Disease severity (0-5 scale)	Reaction
1	BD 4351	1.25	MR
2	BD 4355	2.25	MS
3	BD 4358	1.25	MR
4	BD 4359	2.0	MR
5	BD 4361	1.25	MR
6	BD 4366	2.25	MS
7	BD 4373	1.75	MR
8	BD 4376	2.0	MR
9	BD 4383	0.75	MR
10	BD 4388	1.5	MR
11	BD 4389	2.0	MR
12	BD 4393	2.75	MS
13	BD 4394	2.75	MS
14	BD 4396	2.0	MR
15	BD 4399	2.75	MS
16	BD 4401	3.25	S
17	BD 4406	1.5	MR
18	BD 4407	2.75	MS
19	BD 4412	2.5	MS
20	BD 4413	3.67	S
21	BD 8382	3.67	MS
22	BD 8394	3.33	MS
23	BD 8395	3.0	MS
24	BD 8398	2.0	MR
25	BD 8356	1.33	MR
26	BD 8383	2.33	MS
27	BD 8365	2.0	MR
28	BD 8400	2.67	MS
29	BD 8357	3.0	MS
30	BD 8390	2.67	MS
31	BD 4351	2.67	MS
32	BD 4361	2.0	MR
33	BD 8391	1.33	MR
34	BD 8362	3.0	MS
35	BD 2143	2.66	MS
36	BD 4388	1.0	R
37	BD 8370	2.33	MS
38	BD 8397	1.67	MR
39	BD 8369	1.33	MR
40	BD 8352	2.0	MR
41	BD 8376	3.33	MS
43	BD 8366	2.0	MR
44	BD 203	1.33	MR
45	BD 204	1.0	R
46	BD 205	0.67	R
47	BD 206	3.00	MS
48	BD 207	1.33	MR
49	BD 208	1.33	MR
50	BD 209	1.66	MR
51	BD 210	1.00	R
52	BD 211	2.33	MS
53	BD 212	1.33	MR
54	BD 213	1.67	MR
55	BD 2157	1.33	MR
56	BD 215	1.33	MR
57	BD 216	2.66	MS
58	BD 2174	2.33	MS
59	BD 2150	1.67	MR
60	BD 2151	1.33	MR
61	BD 2177	1.33	MR
62	BD 2153	1.67	MR
63	BD 2147	1.33	MR

Scoring scale, 0 = No disease-Immune (I); 1 = 1-20% area infected- Resistant (R); 2 = 21-40% area infected – Moderately resistant (MR); 3 = 41-60% area infected – Moderately susceptible (MS); 4 = 61-80% area infected – Susceptible (S); 5 = <80% area infected- Highly susceptible (HS).

Table 2. Efficacy of some chemicals in controlling powdery mildew of sweet gourd under at different locations

Fungicides	Group	Dose (%)	Incidence of powdery mildew (PDI)*		Reduction of disease (%)	
			Gazipur	Thakurgaon	Gazipur	Thakurgaon
Mycosulf 80 WP	Sulpher	0.20	11.33b (19.66)	10.78b (19.09)	84.00	83.49
Carbozim 50 WP	Carbendazim	0.10	13.33b (21.40)	12.33b (20.53)	82.00	81.94
Haydazim 50 WP	Carbendazim	0.20	14.00b (21.94)	12.6b (20.79)	81.33	81.67
Censor MZ 72	Mancozeb 64% +Metalaxyl 8%	0.25	13.33b (21.33)	13.93b (21.89)	82.00	80.34
Bendazim	Carbendazim	0.10	14.67b (22.53)	12.67b (20.79)	80.66	81.60
Insuf 80 WP	Sulpher	0.30	12.00b (18.09)	12.40b (20.62)	83.33	81.87
Sulfochem 80 WP	Sulpher	0.25	14.00b (21.94)	12.83b (2096)	81.33	81.44
Thiovit	Sulpher	0.20	12.00b (18.09)	13.33b (21.39)	83.33	80.94
Control (Spray plain water)	-	0.00	95.33a (77.59)	94.27a (76.06)	-	-
CV (%)			12.173	-	-	-

* Values within the parenthesis are arc sign transformed values and means within the same column having the common letter do not differ significantly

Table 3. Assessment of yield loss of sweet gourd due to powdery mildew

Treatment	Percent disease index (PDI)	Yield/plant (Kg)	Yield/ha (T)	Loss of yield over control (T/ha) or %
Spray (Thiovit @ 0.2%)	6.35 (14.09)	22.14	36.89	14.58 or 65.35
Non-spray (Spraying water)	96.08 (78.46)	13.39	22.31	-
t-test	**	**	**	-

Table 4. Cost of sweet gourd cultivation in Bangladesh and cost benefit analysis for sweet gourd at HRC, BARI, Gazipur in 2006-2007 cropping season.

Treatments	Gross return (TK)	Fixed cost (TK)	Variable cost (TK)	Total cost (TK)	Net return (TK)	Benefit cost ratio (BCR)
Spray	553350	54085	2707.25	56792.25	496557.75	1.77
Non-spray	334650	54085	-	54085	280565	-

CONCLUSION

Using powdery mildew-disease resistant high yielding variety with desirable character farmers may benefited to cope with the disease by increasing yield. In case where the resistant variety is not available and local preference of some variety with disease susceptibility are found, chemical control with effective fungicides may help the farmers in reducing yield loss.

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