CONTROL OF *SCLEROTINIA SCLEROTIORUM* (LIB.) de BARY IN INDIAN MUSTARD WITH FUNGICIDES

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Abstract: Among various fungicides used, benomyl and carbendazim proved to be most effective fungicide for seed treatment, spray alone as well as in combination to control *sclerotinia- rot* of Indian mustard (*Brassica juncea(L.) (zern and Coss)*. Seed treatment at sowing time with benomyl (0.2 per cent) followed by spraying at first budding or flowering stage with same dose of fungicide provide best clue for recommendation at farmer's field.

Key words: Indian mustard, *Sclerotinia-rot*, Fungicides, Screening, Spray.

INTRODUCTION

Oil seeds Brassica are widely cultivated throughout the world for edible oil production. The crop is grown in tropical as well as in temperate conditions and prefers cool and moist weather during growing period and dry weather during harvesting. India is one of the leading oil seeds producing country in the world accounting for nearly 18 percent of the world rapeseed production. In India it occupies an area of about 4.4 million ha with an average productivity of about 902 kg/ ha (Anonymous, 2002-03), The relatively low productivity of rapeseed mustard in India is due to several biotic and abiotic factors. Among the major constraints in harvesting higher yield are the diseases like Alternaria blight, white rust, downy mildew, powdery mildew and white stem rot or sclerotinia rot.

Stem rot or white stem rot of Indian mustard incited by *Sclerotinia sclerotiorum* is an economically important yield reducing disease that has assumed serious proportions during last few years. *Sclerotinia sclerotiorum,* a polyphagous and polycyclic soil- borne pathogen causes severe damage at young stage in India (Roy and Saikia, 1976; Purdy, 1979).

The disease symptoms appear four to six weaks after initial infection or a post flowering stage when significant damage has already been done to the crop. Sudden dropping of leaves followed by drying of plants are the important features of the disease. Losses upto 40 per cent have been reported in rapeseed mustard in India (Anonymous, 1999-2000). Sclerotinia stem-rot is gaining importance in the raya growing areas which may lead to disastrous crop failure as the disease incidence upto 80 per cent has been recorded (Kang and Chahal, 2000).

This ascomycete fungus has systemic and aerial infection by myceliogenic and carpogenic germination of *Sclerotinia* surviving in soil even under adverse environmental conditions. In 1986, white rot of crucifers disease was found to be vide spread and severe on yellow sarson and toria in Uttar Pradesh (U.P.) and Bihar (Saxena and Rai, 1987). Considering the omniphagous nature, management of diseases caused by *S. sclerotiorum*, various measures have been tried on several crops (Dueck *et al*., 1983; Singh and Gangopadhyay, 1984; Morrall *et al*., 1985; Singh and Saha, 1989) but the management of disease is still far from satisfaction. In present investigation attempts were made to manage the disease by using different fungicides to achieve the goal.

MATERIALS AND METHODS

1. Effect of Seed treatment on the control of Sclerotinia-rot of Indian mustard.

Captafol, Benomyl, Carbendazim, Mancozeb and Ziram fungicides were selected to treat the seed of Indian mustard (RH 30) at the rate of .0.1, 0.2 and 0.3 per cent (w/w) except Ziram where fungicide was taken on volume basis (w/v) before sowing. Required amount of fungicide was mixed with 100 gm seed of Indian mustard with the help of 500 ml conical flasks and shaken to coat the surface of the seed with fungicides thoroughly except Ziram which was used as slurry treatment.

Inoculum raised on sand oat meat culture was mixed with sterilized sandy loam soil in the ratio of 2.5: 97.5 and

inoculated soil was taken in 30 cm diameter earthen pots. Each pot contained 5 kg of the soil. Thirty treated seeds with each dose of each fungicide were sown in pots with three replications. Two control sets were maintained by sowing untreated seeds in pots (containing sterilized inoculated as well as uninoculated soil). Pots were irrigated at regular interval. Per cent disease incidence was recorded after 35 days of sowing.

2. Effect of Spray of fungicides on the control of Sclerotinia- rot of Indian mustard.

Untreated seeds were sown in inoculated sterilized soil contained in 30 cm diameter earthen pots. The pots received other agronomical operations as per normal requirement. Fifteen days old seedlings were sprayed with the selected dose of benomyl, captafol, carbendazim, mancozeb and ziram in three replicated sets alongwith unsprayed control. Data on disease incidence were recorded before and 15 days after spray.

3. Effect of Seed treatment and spray of fungicides on the control of Sclerotinia – rot of Indian mustard :

Thirty seeds treated with 0.1 and 0.2 per cent doses of carbendazim, benomyl, ziram, captafol and mancozeb fungicides were sown in inoculated sterilized soil in 30 cm diameter pots as described earlier. Fifteen days after sowing, percent disease incidence was recorded from each pot including control sets. After taking observations, plants were sprayed with same doses of each fungicide. Twenty days after spraying, percent disease incidence was recorded.

RESULTS AND DISCUSSION

In recent past sclerotinia-rot of Indian mustard (*Brassica juncea*) has made its appearance in different parts of U.P.

In the present findings, it was observed that younger host is most susceptible than older ones. Five days old mustard seedlings contracted 72.38 per cent disease incidence. Later on, increase in age of host led to decrease in the disease incidence. It may be due to increase in the cortex layer as well as physiological changes in the stem. Mehta *et al*. (1946) correlated differences in quantum of diseases with the woodyness and fibrous nature of host

Screening of fungicides against given pathogen in laboratory condition is essential feature before recommendation of chemical against a particular disease. No doubt, several workers have screened fungicides against *S. sclerotiorum*, the causal organism of stem and root diseases of several crop plants. Effectivity of benomyl, captaf, carbendazim, captafol, mancozeb and ziram have been proved better against insolates of *S. sclerotiorum* (Singh and Gangopadhyay, 1984; Roy and Saikia, 1976; Singh & Saha, 1989; Hawthrone and Jarvis, 1973; Reilly and Lamoureux, 1981; Yarden *et al*., 1986). In the present study, benomyl and carbendazim among the systemics, captaf and ziram among the protectants were found effective to check the growth of *S. sclerotiorum* in labotory conditions (Table-1).

Table. 1. Screenig of fungicide against Sclerotina sclerotiorum under laboratory conditions.

Treatment (fungicide)	Growth inhibition % * concentration *(ug/ml)*						Toxicity Index	Ed_{50}
	10	50	100	250	500	1000		
Benomyl	100	100	100	100	100	100	600	1
Captaf	89.38	100	100	100	100	100	589	10
Captafol	32.35	76.80	100	100	100	100	509	20
Carbendazim	100	100	100	100	100	100	600	1
Copper Oxychloride	32.00	52.00	64.70	70.25	75.20	80.80	383	45
Mancozeb	25.40	63.00	68.00	79.75	88.00	95.50	420	37
MEMC	53.25	100	100	100	100	100	553	10
Ziram	82.35	93.36	100	100	100		476	10

* Average of five replications

No doubt, the value of ED 50 was calculated by these workers were slightly different than present observations. This may be due to the variations in the environmental conditions and handling of the experiment. Nevertheless, these results project same picture and this get positive support of previous work done at various laboratories.

Five fungicides were selected on the basis of their recommendation against *S. sclerotiorum* as well as availability and their performance in in-vitro test. It was noted that benomyl and carbendazim exhibited less disease as compared to other fungicides which were insignificant (Table-2)

Table 2. Effect of seed treatment with selective fungicide on control of Sclerotinia-rot of Indian mustard

Treatment	Percent disease incidence					
	Doses%					
	0.1		0.2		0.3	
Carbendazim	07.79*	(18.63)**	06.00	(11.29)	0.00	-
Benomyl	06.42	(14.65)	04.05	(11.87)	0.00	-
Ziram	08.19	(19.42)	06.62	(14.81)	4.68	(10.74)
Capatafol	17.89	(24.27)	07.33	(17.47)	7.78	(13.24)
MEMC	14.86	(25.46)	07.00	(17.47)	6.05	(12.65)
Control	38.52	(39.67)	-	-	-	-

C.D. at 5% = Treatment: 1.88; Doses : 1.29 TxD: 1.88

* Average of three replication.

** Figure in parenthesis denote angular transformed value.

So, it may be concluded that benomyl and carbendazim exhibited less disease incidence as compared to other fungicides and thus protected the seeding maximum when applied as seed treatment. These observations are in accordance with results obtained by Yarden *et al*. (1986) and Karahan *et al*. (1978). Benomyl and thiram had been found effective for the control of *S. sclerotiorum* on Chinese cabbage (Yarden *et al*., 1986).

None of the fungicides was emerged best from the present investigation in a spray trial conducted under screenhouse (Table-3).

Table 3. Effect of spray of fungicides on the control of Sclerotinia-rot of Indian mustard

Treatment	Percent disease incidence			
	Dose%			
	0.1		0.2	
Carbendazim	32.19*	(33.52)**	25.00	(32.00)
Benomyl	30.77	(32.88)	23.52	(32.07)
Ziram	33.42	(34.06)	27.62	(31.46)
Captafol	34.77	(35.76)	30.63	(32.75)
Mancozeb	37.00	(37.39)	38.38	(39.66)
Control	40.78	(39.25)		

C.D. at 5% = Treatment : 1.09; Doses : 2.00; TxD: 3.20

* Average of three replications.

** Figures in parenthesis denote angular transformed value.

Although foliar spray of benomyl and carbendazim have been advocated to reduce the incidence of S. sclerotiorum at various stages on different Brassica species under field conditions (Sharma & Sharma, 1984; Dueck *et al*., 1983;

Thomson *et al*., 1984; Morrall *et al*., 1985; Singh and Gangopadhyay, 1984; Zazzerini and Tosi, 1985), Whereas Kruger (1973) controlled through application of quintozene and calcium cyanamide on rape crops and on tobacco by thiabendazole (Mangegaz *et al*., 1980). While spray of Iprodione or vinclozolin reduced the incidence of stem-rot of cucumber (Framigham *et al*., 1984).

To achieve the maximum protection of mustard seedlings against S. sclerotiorum, an experiment was laid out, where treated seeds were sown in inoculated soil and the emerged seedlings were sprayed with the same dose of fungicides after 15 days of germination (Table-4).

Table 4. Effect of seed treatment and spray of fungicides on the control of Sclerotinia-rot of Indian mustard.

Treatment	Percent disease incidence			
	Dose%			
	0.1		0.2	
Carbendazim	07.78*	(16.51)**	03.71	(10.86)
Benomyl	05.97	(14.32)	02.26	(09.30)
Ziram	08.44	(16.58)	04.17	(12.05)
Captafol	13.87	(21.24)	06.55	(16.26)
Mancozeb	18.58	(25.12)	14.26	(20.55)
Control	38.25	(37.67)	-	-

C.D. at 5% = Treatment : 1.29; Doses : 1.25; TxD: 1.29

* Average of three replications.

** Figures in parenthesis denote angular transformed value

Benomyl reduced the disease incidence to 2.26 percent and gave maximum protection of seedlings 97.74 percent followed by carbendazim 96.29 percent. These combinations have been found better than seed treatment or spray. However, the difference between the two fungicides were apparently non- significant. Performance of the effectivity of other fungicides was better than control. On the basis of results obtained, it is suggested that seed treatment followed by spray with benomyl or carbendazim can be recommended for effective control of sclerotinia- rot of Indian mustard in the fields.

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