Journal of Oilseed Brassica, 13 (2) : 163-166, July 2022

Short Note

Management of Sclerotinia rot of Indian mustard through fungicides

Jitendra Sharma, Shashi Kant Goyal* and Shailesh Godika

Sri Karan Narendra Agriculture University, Jobner 303329, Jaipur, Rajasthan, India
**Corresponding author: skgoyal.skncoa@sknau.ac.in*
(Received: 02 April 2022; Revised: 17 June 2022; Accepted: 27 June 2022)

Abstract

Indian mustard (*Brassica juncea* L.) is an important oilseed crop and attack of diseases and pests is the most important factor causing yield instability in the crop. Stem rot (*Sclerotinia sclerotiorum)* of Indian mustard is considered to be an economically important yield reducing disease in recent years. Therefore, the present investigations were carried out with the objective to test seven fungicides under *in vitro* (by poisoned food technique) and *in vivo* conditions. Carbendazim and carbendazim 12 % + mancozeb 63 % WP inhibited completely the mycelial growth of *S. sclerotiorum* at all concentrations (50,100 and 150 ppm) followed by captan 70% + hexaconazole 5 % WP with inhibition of 94, 100 and 100 % at 50, 100 and 150 ppm respectively. *In vivo* efficacy of six fungicides tested by applying as seed treatment, foliar application (30 DAS) and seed-cum-foliar application against sclerotinia rot of Indian mustard under soil inoculation pot house conditions with cultivar Varuna (T-59). Carbendazim was found most effective in reducing the disease intensity followed by carbendazim 12 % + mancozeb 63 % WP.

Keywords: *Fungicides, Indian mustard, management, Sclerotinia rot*

Introduction

Indian mustard [*Brassica juncea* (L.) Czern & Coss] is an important oilseed crop, belongs to family *Crucifereae* (*Brassicaceae*). Brassica crops are cultivated for edible vegetable oil production. They also play a vital role in world's agricultural economy. Mustard is the second most important oilseed crop of India after groundnut in terms of area and production. Rajasthan state ranks first both in area and production. The attack of diseases and pests is the most important factor causing yield instability in rapeseed and mustard. Leaf spot and blight (*Alternaria brassiciola* and *Alternaria alternata),* white rust (*Albugo candida),* Sclerotinia rot *(Sclerotinia sclerotiorum),* downy mildew (*Peronospora brassicae),* powdery mildew (*Erysiphe cruciferarum)* are major diseases of mustard. Among these, Sclerotinia rot or stem blight or white blight or white rot of Indian mustard incited by *Sclerotinia Sclerotiorum* (Lib.) de Bary is important yield reducing disease. *S. sclerotiorum* is a necrotropic pathogen caused damage to the plant tissue followed by cell death and development of soft rot or white mould (Purdy, 1979). High incidence of the disease has led to discouragement of the growers. In some districts of Haryana and Punjab 72.8 to 80 per cent disease incidence was recorded (Kang and Chahal, 2000 and Sharma *et al.,* 2001). Yadav *et al.* (2013) reported 17.4 per cent diseases incidence from six districts of Rajasthan. The present investigations were carried out with the objective to test some fungicides against *Sclerotinia sclerotiorum* under *in vitro* and *in vivo* conditions so that these can be used as a component of disease management.

Materials and Methods

Collection and isolation of *S. sclerotiorum*

Sclerotinia rot affected plants of Indian mustard showing partial or total wilting of stems and branches, were collected from farmer's field and isolations were made on potato dextrose agar (PDA) medium from black sclerotia present inside the diseased stem as well as from individual stem rot lesion as per procedure and culture purified by hyphal tip method (Riker and Riker, 1936).

In vitro efficacy of fungicides against *S. sclerotiorum*

Seven fungicides [Propineb 70 % WP (Antracol); carbendazim 50 % WP (Bavistin); carbendazim 12 % + mancozeb 63 % WP (Companion); mancozeb 75 % WP (Indofil M-45); cymoxanil 8 % + mancozeb 64 % WP (Moximate); metalaxyl 8 % + mancozeb 64 % WP (Ridomil Gold); captan 70 % + hexaconazole 5 % WP (Steam)] were evaluated with three (50,100 and 150 ppm) concentrations against the *S. sclerotiorum* under

laboratory conditions to find out per cent inhibition on growth of the pathogen in culture by poisoned food technique (Schmitz,1930). Requisite quantity of each fungicide was incorporated in sterilized two per cent PDA medium, thoroughly mixed by shaking prior to pouring in sterilized Petri plates and were allowed to solidify. These Petri plates were inoculated with 5 mm dia. disc of seven-days old culture of the pathogen in the centre of the plate and incubated at 25 ± 1 ^{0}C. Each treatment was replicated thrice with suitable control. The efficacy of fungicides in each treatment and average of three replications were calculated. Per cent mycelial growth inhibition was calculated using formula as suggested by Bliss (1934).

$$I = \frac{(C-T)}{C} \times 100$$

Where, I = Per cent mycelial growth inhibition, C = Growth of fungal plant pathogen in control (mm), T = Growth of fungal plant pathogen in dual culture plate (mm)

In vivo efficacy of fungicides against sclerotinia rot of Indian mustard

The experiment was carried out in earthen pots (30 cm dia.) with cultivar Varuna (T-59). The pathogen multiplied on sorghum grains at 25 ± 1 ^{0}C for one week was used as the soil inoculum. Prior to sowing, pots were surface sterilized with copper sulphate solution and filled with sterilized soil. The soil was sterilized at 1.045 kg/cm^2 for one hour for three consecutive days. These pots were inoculated with fungal inoculum multiplied on sorghum grains before sowing. For inoculation the upper 5 cm layer of soil of each pot was thoroughly mixed with inoculum @ 20 g/pot. 10 seeds were maintained per pot and kept in cage house. Six fungicides [Carbendazim 50% WP (Bavistin); carbendazim 12 % + mancozeb 63 % WP (Companion); mancozeb 75 % WP (Indofil M-45); cymoxanil 8 % + mancozeb 64 % WP (Moximate); metalaxyl 8 %+ mancozeb 64 %WP (Ridomil Gold); captan 70% + hexaconazole 5 % WP (Steam)] fungicides were applied as seed application, foliar application (30 DAS) and seed-cum-foliar application in four replications. At 30 DAS, 0.1 % of carbendazim and 0.2 % of rest of the fungicides were used as single foliar spray.

The plants showing even a minute lesions on stem due to disease was considered as a diseased plant. Disease rating (0-4) scale (Plate 1) of Lesovoi *et al.* (1987) and Sansford (1995) with a slight modification was followed to assess intensity as: 0 = Healthy (no visible lesion); 1 = 0.1-2 cm lesion length on stem; 2 = 2.1-4.0 cm; 3 = 4.1-6.0 cm; 4 = > 6.1 cm lesion length on stem or complete dried plant. The length of lesion on infected stem was considered for recording the disease intensity. The infected area was calculated from 10 plants in each pot and then average for each treatment was worked out. The % disease intensity was calculated using the formula of Wheeler (1969) :

Plate 1: Sclerotinia rot disease rating scale

Results and Discussion

In vitro efficacy of fungicides against *S. sclerotiorum*

The efficacy of fungicides was evaluated against *S. sclerotiorum* on PDA by poisoned food technique. The data suggested (Table 1) that increase in concentration of the fungicides caused increased inhibition of mycelial growth of the fungus. Among these, carbendazim and carbendazim 12 % + mancozeb 63 % WP inhibited completely the mycelial growth of *S. sclerotiorum* at all concentrations (50,100 and 150 ppm). This was followed by captan 70 % + hexaconazole 5 % WP with inhibition of 94, 100 and 100 % at 50, 100 and 150 ppm respectively. Propineb was found least effective at all concentrations against *S. sclerotiorum*. At 50 ppm concentration mancozeb and metalaxyl 8 % + mancozeb 64 %WP were found at par with each other. Effectiveness of carbendazim and carbendazim 12 % + mancozeb 63 % WP against *S. sclerotiorum* has also reported by earlier workers. Chattopadhyay *et al.* (2002), Pandey *et al.* (2011) and Singh *et al.* (2014) reported carbendazim as significantly superior in inhibiting mycelial growth of *S. sclerotiorum.* While Javeria *et al.* (2014) reported carbendazim and carbendazim 12 % + mancozeb 63 % WP were significantly superior in inhibiting mycelial growth of *S. sclerotiorum.*

In vivo efficacy of fungicides against sclerotinia rot of Indian mustard

Six fungicides found better in poisoned food technique, were used *in vivo* conditions through seed application, foliar application and seed-cum-foliar application in a pot experiment.

Seed application

A perusal of data (Table 2) revealed minimum disease intensity with carbendazim (30.6 %) followed by carbendazim 12 % + mancozeb 63 % WP (35.6 %) as compared to control (77.5 %). Maximum reduction in per

Table: 1 *In vitro* efficacy of fungicides against *S. sclerotiorum* by poisoned food technique after 7 days of incubation at 25 ± 1^{0}C

Fungicides	% mycelial growth inhibition at various concentrations (ppm)			
	50	100	150	Mean
Propineb	5.9 (14.0)*	17.4 (24.7)	47.8 (43.7)	23.7
Carbendazim	100 (90.0)	100 (90.0)	100 (90.0)	100
Carbendazim + Mancozeb	100 (90.0)	100 (90.0)	100 (90.0)	100
Mancozeb	38.8 (38.5)	51.5 (45.9)	70.4 (57.1)	53.6
Cymoxanil + Mancozeb	51.9 (46.1)	68.2 (55.7)	84.4 (66.8)	68.2
Metalaxyl- M + Mancozeb	39.7 (39.0)	54.1 (47.4)	78.5 (62.4)	57.4
Captan + Hexaconazole	94.4 (76.4)	100 (90.0)	100 (90.0)	98.1
Control	0.0	0.0	0.0	0.0
Mean	53.8	61.4	72.6	
			SEm±	CD (p=0.05)
		F	0.69	1.97
		C	0.42	1.21
		F×C	1.20	3.42

*Figures given in parentheses are angular transformed values

cent disease intensity over control was observed with carbendazim (60.5 %) followed by carbendazim 12% + mancozeb 63 % WP (54.0 %) over control. Per cent disease intensity of captan 70 % + hexaconazole5 % WP (36.2 %) was found at par with companion (35.6 %) and per cent disease intensity of metalaxyl 8 %+ mancozeb 64 % WP (50.0 %) was found at par with mancozeb (52.5 %) respectively. Minimum reduction in disease intensity was observed in mancozeb (32.2 %).

Foliar application

A perusal of data (Table 2) revealed that the highest reduction in disease intensity over control was observed in carbendazim (52.3 %) followed by carbendazim 12 % + mancozeb 63 % WP (49.2 %). Per cent disease intensity of carbendazim 12 % + mancozeb 63 % WP (41.2 %) was found at par with carbendazim (38.7%) and per cent disease intensity of mancozeb (58.1 %) was found at par with metalaxyl 8 % + mancozeb 64 % WP (55.6 %). Minimum reduction in disease intensity was observed in mancozeb (28.5 %).

Seed-cum-foliar application

A perusal of data (Table 2) revealed minimum per cent disease intensity in carbendazim (21.2 %) followed by carbendazim 12 % + mancozeb 63 % WP (23.7 %) over control (78.7 %). Maximum reduction in disease intensity over control was observed in carbendazim (73.0 %)

Table 2: *In vivo* efficacy of fungicides against sclerotinia rot of Indian mustard

Fungicide	Dose	Seed application		Foliar application		Seed-cum-foliar application	
	(%)	Disease intensity (%)	% Disease control	Disease intensity (%)	% Disease control	Disease intensity (%)	% Disease control
Carbendazim	0.1	30.6(33.6)*	60.5	38.7(38.5)	52.3	21.2(27.4)	73.0
Carbendazim + Mancozeb	0.2	35.6(36.6)	54.0	41.2(40.0)	49.2	23.7(29.2)	69.8
Mancozeb	0.2	52.5(46.4)	32.2	58.1(50.0)	28.5	47.5(43.6)	39.7
Cymoxanil + Mancozeb	0.2	43.7(41.4)	43.5	50.6(45.4)	37.7	36.9(37.4)	53.2
Metalaxyl- M + Mancozeb	0.2	50.0(45.0)	35.5	55.6(48.2)	31.5	43.7(41.4)	44.4
Captan + Hexaconazole	0.2	36.2(37.0)	53.2	44.4(41.8)	45.4	28.7(32.4)	63.5
control	-	77.5(61.7)	0.0	81.2(64.3)	0.0	78.7(62.5)	0.0
SEm±		0.99	-	0.89	-	0.84	-
CD (p=0.05)		2.96	-	2.66	-	2.50	-

*Figures given in parentheses are angular transformed values

followed by carbendazim 12 % + mancozeb 63 % WP (69.8 %). Per cent disease intensity of carbendazim 12 % + mancozeb 63 % WP (23.75 %) was found at par with carbendazim (21.2 %). Minimum reduction in disease intensity was observed in mancozeb (39.7 %).

Among these methods, seed treatment-cum-foliar application of fungicides was found most effective in by reducing disease intensity, followed by seed application and foliar application alone. All fungicides were able to reduce the disease intensity significantly over control. Carbendazim was the best in reducing the disease intensity followed by carbendazim 12 % + mancozeb 63 % WP. These results are in agreement with the results of Pathak and Godika (2002), Zewain *et al.* (2005), Ghasolia and Shivpuri (2008), Choudhary *et al.* (2010) and Sharma *et al.* (2011). They reported efficacy of carbendazim in disease control against *S. sclerotiorum*.

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