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EFFECT OF FUNGICIDES ON MYCELIUM GROWTH OF SCLEROTINIA STEM ROT CAUSED BY *SCLEROTINIA SCLEROTIORUM* IN INDIAN MUSTARD

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ABSTRACT

The experiment was conducted at Department of plant Pathology, College of Agriculture, RVSKVV, Gwalior (M.P.) during 2014-15. It was carried out to evaluate the efficacy of different fungicides on mycelial growth of Sclerotinia stem rot caused by *Sclerotinia sclerotiorum* under *in-vitro* by poisoned food technique. From the present study it could be concluded that carbendazim 50% WP, propiconazole 25% EC and thiophanate methyl 70% WP were recorded completely inhibited mycelial growth and formation of sclerotia, followed by hexaconazole 5% SC (80.46% and 0.667), thiram 75% SD (72.65% and 1.333), ridomil (71.08% and 1.333) and mancozeb 75% WP (69.53% and 0) were found least effective but copper oxychloride 50%WP (44.13% and 1.333) and sulphur 80% WDG (13.66% and 2.333) were inhibited at par control (0.00% and 3.333) on mycelial growth and formation of sclerotia respectively.

INTRODUCTION

Indian mustard (*Brassica juncea* (L.)Czernj.Cosson) is the largest oilseed economy crop in the world as source of edible vegetable oil. It is also known Raya or Laha. The Rapeseed-Mustard production trends represent fluctuating scenario with an all-time high production. In India, rapeseed mustard occupy an area of 63.40 lakh ha with a production of 78.20 mt and productivity of 1234.40 kg / ha (FAO, 2014). Major rapeseed mustard growing states are Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka and Andhra Pradesh, Madhya Pradesh ranks 4th in area 8.00 lakh hectares with 11.40 MT production and 1425 kg / ha productivity. District of Gwalior contributes 0.563 lakhs hectares of area with 0.612 MT production and 1088 kg/ ha productivity (Farmer Welfare and Agriculture Development, Bhopal, Madhya Pradesh, 2014). *Sclerotinia sclerotiorum* (Lib) De Bary, the causal fungus of Sclerotinia stem rot, is a necrotrophic pathogen with worldwide distribution known to have a wide host range, known to infect about 75 families, 278 genera, 408 plant species and 42 sub-species with most of them present in dicotyledonae subclass of Angiospermae (Boland and Hall, 1994) with no proven source of resistance against disease till date in any of the hosts. Sclerotinia stem rot is also known as polio disease of mustard crop in northern region of Madhya Pradesh. This ascomycete can cause systemic and aerial infection by myceliogenic and carpogenic germination. Large numbers of sclerotia are formed in soil on dead organic matter, on roots, on and inside the pith of stem in rapeseed-mustard crop that is serving as source of primary inoculum for the next season. Sclerotinia stem rot has become an economically important yield reducing factor especially in raya (*Brassica juncea*) and is causing 40-80 per cent losses in yield (Mehta *et al*., 2010). The maximum Sclerotinia stem rot incidence recorded in field of mustard growers of Rajasthan was 90 per cent, (NCIPM Newsletter, 2010). The disease was of minor importance till few years back, but recently it has assumed a serious problem in major mustard growing areas in country (Tripathi and Tripathi, 2009). Sclerotinia stem rot is a disease that has become significant in recent times in India and elsewhere. Hence, the aim of present investigation was undertaken to formulate the effective strategies to manage this emerging problem.

MATERIALS AND METHODS

The experiment was laid out in a complete randomized design (CRD) with 10 treatments including untreated control and replicated thrice. Nine fungicides *viz.*, carbendazim 50% WP (0.1%), mancozeb 75% WP (0.2%),copper oxychloride 50% WP (0.2%), thiophanate methyl 70% WP (0.1%), sulphur 80% WDG (0.2%), thiram 75% SD (0.1%); propiconazole 25% EC (0.1%), hexaconazole 5% SC (0.1%) and ridomil (0.1%) belonging to different groups were evaluate against *S. sclerotiorum*. The present study was undertaken in the laboratory conditions to find out their relative efficacy to inhibit the mycelial growth and formation of sclerotia on PDA medium by poisoned food technique (Nene and Thapliyal, 1979). The calculated quantity of fungicide was added to potato dextrose agar (PDA), mixed thoroughly and poured into sterilized Petriplates and allowed to solidify. After solidification, each plate was inoculated with a 5 mm diameter disc obtained from an actively growing margin of *S. sclerotiorum* mycelial growth on PDA. The Petri dishes (90mm) were incubated at 25±1ºC in BOD incubator and allow to mycelial growth and Formation and development of sclerotia. The data of efficacy of fungicides against *S. sclerotiorum* was recorded after 7 days after inoculation (DAI) for mycelial growth of pathogen, whereas, the number of sclerotia were recorded after fifteen DAI at 25±1ºC. Per cent over control was calculated by the following formula suggested by Vincent (1947).

$$\text{Per cent inhibition} = \frac{C - T}{C} \times 100$$

C = growth of fungus in control

T = growth of fungus in treatment

Fungicides were evaluated the tested fungicides could give cent per cent inhibition of mycelial growth of *Sclerotium rolfsii* except carbendazim that gave 57.44 per cent mycelial growth inhibition. Systemic fungicides like hexaconazole (0.1%), propiconazole (0.1%) or combiproducts like carboxin 37.5% + thiram 37.5% (0.1%) and carbendazim + mancozeb (0.2%) were the best with no wilt incidence, (Hegde, *et al.,* 2014).

RESULTS AND DISCUSSION

Effect on mycelial growth inhibition

In-vitro studies revealed that fungicides like carbendazim, propiconazole and thiophanate methyl showed complete inhibition of mycelial growth and formation and development sclerotia against *S. sclerotiorum*, summarized in (Table 1). Out of nine fungicides, carbendazim, thiophanate methyl and propiconazole had none mycelial growth recorded, while, Copper oxychloride 44.13 percent and sulphur 13.66 percent were inhibited which were not significantly effect to inhibit mycelial growth. However, Hexaconazole 80.46, thiram 72.65, ridomil 71. 08 and mancozeb 69.53 percent were effective exhibiting mycelial growth against *S. Sclerotiorum* respectively, as compare to control 100 percent well mycelial growth was recorded, as it did not cause substantial reduction in growth of the pathogen as compared to control. Tripathi and Tripathi, (2010) reported that all the evaluated fungicides except with sulphur dust 6.00 mm. growth of the pathogen was recorded and thereby 93.33 per cent inhibition in mycelial growth of the pathogen was recorded against control. All the fungicides were significantly effective in inhibiting the growth of the pathogen. Matco, carbendazim, thiophanate methyl, propiconazole and hexaconazole were found to be most effective fungicide, as there was no growth of the fungus observed in control. *In-vitro* evaluated Fungicides, carbendazim, thiophanate methyl, propinoconazol completely inhibited mycelial growth, while, mancozeb, captan and Blitox-50 found the least effective fungicide at par control, similar findings recorded by (Pandey *et al.,* 2011). Bindu Madhavi and Bhattiprolu (2011) reported that difenconazole, hexaconazole and propiconazole were efficient in inhibiting the mycelial growth of *S. rolfsii* causing chilli dry root rot under *in vitro* conditions. Efficacy of propiconazole (0.10%) and hexaconazole (0.1%) under *in vitro* against *S. rolfsii* has also been reported by Vinod (2006). Similar results were obtained by Prakash and Puri. (2012) reposted that among the five systemic fungicides tested, Contaf was highly effective in reducing mycelial growth of *S. oryzae* at low concentration. Of the four non-systemic (contact) fungicides Chlorothalonil was highly effective against the pathogen under *In-vitro*. The results indicated that Bavistin was comparatively less inhibitory to the bioagents and it also gave satisfactory inhibition to the pathogen growth.

Effect on sclerotia production

Sclerotia are surviving structural body produced by *S. sclerotiorum*. The evaluated fungicides like, carbendazim, thiophanate Methyl and propiconazole each was not recorded sclerotia in petri dises, while, while, hexaconazole 0.667 produced sclerotia. Mancozeb was found effective to check the formation of sclerotia only but it was unable to inhibit the mycelial growth of fungus. Thiram, copper oxychloride and ridomil were formed 1.333 sclerotia formed per Petri plate. However, sulphur 2.333 had produced highest number of sclerotia per plates as against3.333 sclerotia per petri plate (Shivpuri and Gupta, 2001) reported that carbendazim, thiophanate Methyl and phenylpyrrole were not recorded sclerotia but the mancozeb and zinc propylene bisdithiocarbamate have, however produced only a few sclerotia. Copperoxychloride was observed maximum number of sclerotia per plates compared to control, hence that it was effective only for reducing inoculums of pathogen.The information obtained in the present investigation seems to be useful forinhibiting the mycelial growth formation of sclerotia of S. *sclerotiorum*. *In vitro* effect of two systemic fungicides

Table 1: Effect of fungicides on mycelial l growth of mycelium and formation of sclerotia of *Sclerotinia sclerotiorum*

S.No	Fungicides	Conc.	Radial growth in MM	Percent inhibit	Number of sclerotia
1	Hexaconazole 5% SC	0.2	16.67	80.46	0.667 (1.052)
2	Carbendazim 50 % WP	0.2	0.00	100.00	0(0.707)
3	Ridomil	0.1	24.67	71.08	1.333(1.344)
4	Mencozeb 75% WP	0.1	26.00	69.53	0(0.707)
5	Thiophanate Methyl 70% WP	0.1	0.00	100.00	0(0.707)
6	Propiconazole 25% EC	0.1	0.00	100.00	0(0.707)
7	Copper oxychloride	0.1	47.67	44.13	1.333(1.29)
8	Sulphur 80% WDG	0.1	73.67	13.66	2.333(1.678)
9	Thiram 75% SD	0.2	23.33	72.65	1.333(1.344)
10	Control		85.33	0.00	3.333(1.954)
	CV		5.10		53.00(19.019)
	CD		2.58		0.933(0.372

viz., carbendazim and metalaxyl at different concentrations (25, 50 and 100 mg/ml) and three non-systemic *viz.,* Captaf, mancozeb and copper oxychloride at different concentrations (100, 250 and 500 mg/ml) were evaluated against mycelial growth and sclerotia production of *Sclerotinia sclerotiorum* causing stem rot in mustard. Among all the five fungicides carbendazim was observed to compactly (100%) inhibit the mycelial growth and sclerotial production of the fungus. Chand *et al.* (2009).Similar findings on fungicides reported that the application of tebuconazole 2%DS @ 1g/kg seed to groundnut kernels prior to sowing was found to be highly effective with least disease incidence (7.31%). The fungicide was also very effective in farm and large scale demonstration trials in controlling the stem rot (*Sclerotium rolfsii*)and also resulted higher percent increase in yield (9.95%) over recommended fungicide carbendazim 3g/kg seed. (Gururaj, 2012).

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