International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(6): 1282-1285
© 2019 IJCS
Received: 22-09-2019
Accepted: 24-10-2019

Neelu
Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Ashok Kumar Koshariya
Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Greena KK
Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Lokeshwari Thakur
Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Kishan Kumar Sharma
Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Dr. N Khare
Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Dr. AS Kotasthane
Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Corresponding Author:
Neelu
Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Management of collar rot disease of brinjal in Raipur, Chhattisgarh

Neelu, Ashok Kumar Koshariya, Greena KK, Lokeshwari Thakur, Kishan Kumar Sharma, Dr. N Khare and Dr. AS Kotasthane

Abstract
Collar rot disease is one of the major disease of brinjal caused by *Sclerotium rolfsii* Sacc. The experiment on the management of collar rot disease of brinjal was conducted during *kharif* 2018 at Department of Plant Pathology, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). Management of collar rot disease were carried out by bioagents, botanical extracts and fungicides. The *in-vitro* evaluation revealed highest average mycelial growth inhibition with fungicides, Tebuconazole (94.38%), Mancozeb 75% WP (77.52%) and Carbendazim 50% WP (65.19%). Among bioagents highest inhibition percent was recorded with *Pseudomonas fluorescens* isolate 12(64.97%) and *Trichoderma harzianum* (34.02%). Among the botanical extracts 100% inhibition against pathogen was recorded with garlic extract.

Keywords: Brinjal, *S. rolfsii*, fungicides, botanical extracts, bioagents

Introduction
Brinjal is an important vegetable crop grown in India and other countries. It belongs to solanaceae family. It is mainly grown in tropical and sub-tropical region. Brinjal is said to be the native of India (Thompson and Kelly, 1957) [2]. Brinjal crop is commercially grown in many countries *viz.*, Bangladesh, Pakistan, China, Indonesia, Egypt, France, Italy and United states. On commercial basis it is grown as an annual crop. China is the leading country for brinjal crop SSproduction. Leaves and roots of brinjal plant contain solanin. Purple colour of brinjal fruit is due to anthocyanin pigment. It is good for diabetic patients. Presence of glycoalkaloids produces bitter taste in brinjal fruit. Brinjal fruit is rich in free reducing sugars, total water-soluble sugar and good source of dietary fiber. It reduces the risk of coronary heart diseases. It has also anti-rheumatic and anti-asthmatic property. Fruit contain phenolic acid and ascorbic acid which are antioxidants. Brinjal is grown as commercial crop throughout India. Brinjal can be grown in wide range of climatic conditions.

Brinjal crop production is adversely affected by damping off, *Alternaria* blight, bacterial wilt and collar rot disease. Brinjal collar rot is caused by *Sclerotium rolfsii*. It is a severe disease of crop causing high yield losses. It can cause upto 30-50% yield loss (Siddique *et al.*, 2016) [1].

Collar rot disease was caused by the pathogen *Sclerotium rolfsii* Sacc. *Sclerotium rolfsii* Sacc is a necrotrophic soil borne fungi with wide host range, infecting ornamentals, vegetables, fruits and field crops. *Sclerotium rolfsii* produce white mycelium with fan shaped pattern on infected plant part. Clamp connection may be present in hyphae. It produces spherical sclerotia of 0.5 to 1.5 mm diameter. Initially the sclerotia are white in colour and produce clear to pale yellowish coloured droplets. White coloured sclerotia later become dark brown in colour and resembled mustard seeds. Usually, *Sclerotium rolfsii* infect the plant part which is in contact with soil. It kills the plant tissue by production of oxalic acid and enzymes which degrades cell wall. *Sclerotium rolfsii* overwinters as sclerotium in soil. Water soaked lesion is produced by *Sclerotium rolfsii* on collar region and lower stem tissue of plant followed by yellowing and wilting of plant. Fan shaped white mycelial growth appear on affected tissue is characteristic diagnostic sign of pathogen. (Wilson, 1953) [3].

Material and methods
In vitro evaluation of fungicides
The efficacy of 6 fungicides (Tebuconazole 25% EC, Carbendazim 50% WP, Thiophanate methyl 70% WP, Benomyl 50% WP, Copper oxy chloride 50% WP and Mancozeb 75% WP)

was evaluated *in vitro* at different concentrations *viz.*, at half of the recommended dose, at recommended dose and at 500 ppm more concentration than recommended dose against *S. rolfsii*, applying poisoned food technique (Nene and Thapliyal, 1993). Each of the test fungicide and its test concentrations replicated thrice. All the plates were inoculated aseptically with a 5 mm culture disc obtained from a week-old actively growing pure culture of *S. rolfsii*. The culture disc was placed on PDA in an inverted position in the centre of Petri-plate and plates were incubated at 28±2°C. Petri plates filled with plain PDA (without any fungicide) and inoculated with the culture disc of *S. rolfsii* were maintained as the control

Observations on radial mycelial growth/colony diameter were recorded at an interval of 24 hours, continued till the control plates were fully covered with mycelial growth of the test pathogen and finally computed the average colony growth. Per cent mycelial growth inhibition of test pathogen with test fungicides over the control was calculated.

***In vitro* evaluation of bioagents**

Two fungal antagonists, *viz. Trichoderma viride* and *T. harzianum*, were evaluated *in vitro* against *S. rolfsii*, applying dual culture technique (Dennis and Webster, 1971). In dual culture technique four to five days old cultures of test bioagents and pathogen (*S. rolfsii*) were used for the study. The culture discs (5 mm dia.) of the test pathogen and bioagents were cut out with sterilized cork borer. Then two culture discs, one each of the test pathogen and bioagent were placed aseptically at equidistance and exactly opposite with each other on solidified PDA medium in Petri plates and plates were incubated at 28±2°C. Three replications were maintained. The PDA plates inoculated only with culture disc of test pathogen were maintained as the control.

One bacterial antagonist *viz. Pseudomonas fluorescens* were evaluated *in vitro* against *S. rolfsii* by funnel technique (Kotasthane *et al*.). In funnel technique PDA and King's B media were mixed in equal proportion and poured in petriplates (9mm diameter). Mycelial disc of *Sclerotium rolfsii* (5mm) was transferred in the center of petriplate (containing mixed PDA and King's B media). Funnel is sterilized with alchohol followed by flame sterilization then dipped in liquid broth of *Pseudomonas fluorescens*. Excess inoculums were removed by shaking off the funnel followed by gently placing the funnel around mycelial disc of *Sclerotium rolfsii* in such a manner that the margin of funnel touches the solid media on petriplates. Inoculation by funnel should be done almost equidistant from the centrally placed mycelial disc of *Sclerotium rolfsii*. The inoculated plates were incubated in incubator at 28±2^{0}C. Obsevation was taken after 3 days of inoculation. Plates without inoculation of *Pseudomonas fluorescens* served as control plates.

Observations on linear mycelial growth of the test pathogen and bioagents and were recorded after 3 days of inoculation and computed the average colony growth. Per cent inhibition of test pathogen by bioagents over the control was calculated.

***In vitro* evaluation of botanicals**

Aqueous extracts of 5 botanicals *viz*., Garlic, Onion, Neem, Ginger and Tulsi extracts were tested against *Sclerotium rolfsii* by poison food technique under *in vitro* condition. at two different concentrations (5% and 10%). Aqueous extracts of the test botanicals were prepared by grinding with mixture-cum grinder. The 100 g washed leaves of each of the test botanical were macerated separately in 100 ml distilled water (w/v) and the macerate obtained was filtered through double layered muslin cloth. The final clear extract/filtrates obtained formed the botanicals standard aqueous extract of 100% concentration. These were evaluated (@ 5% and 10% each) *in vitro* against *S. rolfsii*, applying poisoned food technique (Nene and Thapliyal, 1993). The PDA medium amended separately with the test aqueous extract was then poured (20 ml/plate) into sterile glass Petri plates (90 mm diameter) and allowed to solidify at room temperature. For each test botanical extract and their respective concentrations, three replications were maintained. Upon solidification of PDA amended with the test botanicals extract, all the treatment plates were aseptically inoculated by placing in centre a 5 mm mycelial disc obtained from a week old actively growing pure culture of *S. rolfsii*. Plates containing plain PDA without any botanical extract and inoculated with mycelial disc of the test pathogen served as the control. All these plates were then incubated at 28 ± 2°C temperature for a week or till the control plates were fully covered with mycelial growth of the test pathogen. Observations on radial mycelial growth/colony diameter were recorded after 3 days of inoculation till the control plates were fully covered with mycelial growth of the test pathogen and computed the average colony growth. Per cent mycelial growth inhibition of the test pathogen over untreated control was calculated (Vincent, 1927).

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

Where,
I = Percent inhibition
C= Radial growth in control
T= radial growth in treatment

Results and discussion

Effect of fungicides

The results indicated that all the fungicides tested at three different concentrations inhibited mycelial growth of *S. rolfsii* significantly over the control and its redial mycelial growth was decreased but its inhibition increased with increase in concentrations of the fungicides tested (Table 1). At three different concentrations significantly highest inhibition percent was recorded with with fungicide Tebuconazole 25 EC (100%), followed by Mancozeb 75% WP (85.39%, 64.04% and 83.15%) and Carbendazim 50% WP (65.17%, 59.55% and 73.03%). Lowest inhibition of mycelial growth was showed by Benomyl 50% WP (23.60%) at half of the recommended dose, Copper oxy chloride 50% WP at actual dose (34.00%) and Benomyl 50% WP (41.57%) at 500 ppm more than recommended concentration. Tebuconazole was found most effective against *S. rolfsii* at all the three different concentrations.

Efficacy of fungicides against *Sclerotium rolfsii* by poisoned food technique. Among the different fungicides, highest inhibition of mycelial growth was recorded with fungicide i.e. Vitavax (100%) followed by Tebuconazole (99.25%) and Penconazole (99.03%). Suryawanshi *et al.* (2015) [7].

Effect of bioagents

Among the tested different isolates of bioagents, highest inhibition percent was recorded with *Pseudomonas fluorescens* isolate 12 (64.97% by funnel technique) followed by *T. harzianum* 94a (34.02%) and *T. viride* IRRI 2 (22.22%) against *S. rolfsii*.

Efficacy of *Pseudomonas fluorescens* was tested to inhibit the mycelial growth of *Sclerotium rolfsii* by dual culture technique under *in vitro* condition. Inhibition of mycelial growth of *Sclerotium rolfsii* was 63.15% by *P. fluorescens* (Dewangan *et al.* 2014) [5].

Highest inhibition of mycelial growth of *Sclerotium rolfsii* was recorded with *Trichoderma harzianum* (63.60%) followed by *Trichoderma virens* (51.5%) and lowest inhibition percentage was recorded with *Trichoderma viride* (50.85%) (Kushwaha *et al.* 2018) [6].

Effect of botanicals extract

Among the all tested botanicals extracts, garlic extract significantly inhibited mycelial growth (50.43% and 100%) followed by neem (35% and 51.1%), ginger (13.8% and 15.5%) and onion (7.5% and 13.8%) at both the concentrations (5% and 10%) respectively against *S. rolfsii* over the control. Lowest inhibition percentage was showed by tulsi extract (7.2% and 9.4%) at 5% and 10% concentrations respectively.

Among the tested botanical extracts, highest inhibition percentage was showed by onion bulb extract (97.77%, 98.88% and 100%) at 5%, 10% and 15% concentration respectively followed by garlic extract (97.77%, 98.88% and 100% inhibition) at all the three applied concentrations. Neem leaf extract showed 75.55%, 91.11% and 61.67% inhibition followed by tulsi leaf extract which showed inhibition (38.88%, 50% and 53%) of mycelial growth at three selected concentrations (5%,10% and 15% concentration) respectively (Sahana *et al.* 2012).

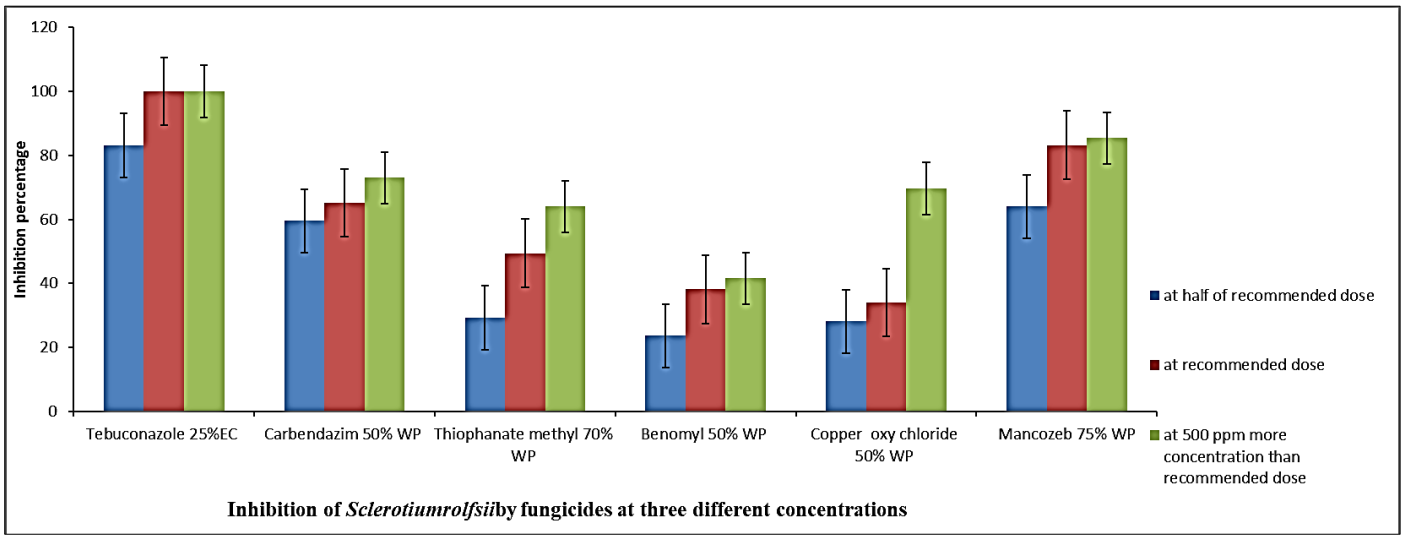

Fig 1: Inhibition of *Sclerotiumrolfsii*by fungicides at three different concentrations

Table 1: Efficacy of fungicides against *Sclerotiumrolfsii*by poisoned food technique at three different concentrations

Sl. No.	Name of the fungicides	Inhibition % at half of the recommended dose	Inhibition % at actual dose	Inhibition % at 500 ppm more than recommended concentration
1.	Tebuconazole 25%EC	83.15 (65.76)	100(90.00)	100 (90.00)
2.	Carbendazim 50% WP	59.55(50.51	65.17 (53.83)	73.03(58.71)
3.	Thiophanate methyl 70% WP	29.21(32.72)	49.44 (44.68)	64.04(53.15)
4.	Benomyl 50% WP	23.60 (29.06)	38.20 (38.17)	41.57 (40.15)
5.	Copper oxy chloride 50% WP	28.09 (32.01)	34.00 (35.67)	69.66 (56.58)
6.	Mancozeb 75% WP	64.04 (53.15)	83.15 (65.76)	85.39 (67.53)
7.	Control	0	0	0
	SE(m)±	0.69	0.54	1.16
	C.D. (5%)	2.46	1.92	4.10

Sl. No.	Isolates of *Pseudomonas fluorescens*	Mean Inhibition%
1.	P1	35.02 (36.28)
2.	P2	46.89 (43.22)
3.	P3	12.99(21.13)
4.	P4	24.85(29.90)
5.	P5	49.71 (44.83)
6.	P6	35.02(36.28)
7.	P7	55.30(48.08)
8.	P8	47.45(43.54)
9.	P9	45.19(42.24)
10.	P10	55.36(48.08)
11.	P11	56.49(48.73)
12.	P12	64.97(53.71)
13.	P13	51.97(46.13)
14.	P14	42.37(40.61)
15.	P15	45.76 (42.57)
16.	P16	42.37 (40.61)
17.	P17	39.54 (38.96)

18.	P18	44.06 (41.59)
19.	P19	48.02 (43.87)
20.	P20	55.39 (48.08)
21.	P21	25.98 (30.64)
22.	P22	40.67 (39.62)
23.	P23	53.10 (46.78)
24.	P24	52.54 (46.46)
25.	P25	40.67 (39.62)
	Control	0
	SE(m)±	2.29
	C.D. (5%)	6.72

Sl. No.	Treatments	Inhibition percentage at 5% concentration	Inhibition percentage at 10%concentration
1.	Garlic	50.43(45.25)	100 (90.00)
2.	Ginger	13.8(23.81)	15.5 (23.18)
3.	Onion	7.5(15.89)	13.8 (23.18)
4.	Tulsi	7.2(15.56)	9.4 (17.85)
5.	Neem	35(36.27)	51.1(45.63)
6.	Control	0	0
	SE(m)±	0.18	0.39
	C.D. (5%)	0.64	1.38

Sl. No.	Isolates of *Trichoderma spp.*	Mean of inhibition percentage
1.	IRRI2 (*Trichoderma viride*)	22.22(28.12)
2.	T14 (*Trichoderma viride*)	28.47(32.25)
3.	Tv1 (*Trichoderma viride*)	25.69(30.45)
4.	94a (*Trichodermaharzianum*)	34.02(35.68)
5.	Control	100(90.00)
	SE(m)±	1.06
	C.D. (5%)	3.38

References

1. Siddique MNA, Ahmmed ANF, Jahan N, Mazumder MGH, Islam MR. Management of foot and root rot disease of eggplant (*Solanum melongena* L.) caused by Sclerotium rolfsii under *in vivo* condition. Scientia. 2016; 16(1):78-86.
2. Thompson CH, Kelly CM. Vegetable crops Mc Graw – Hill Book Co. Inc. U.S.A, 1957, 611p.
3. Wilson C. Preventing the diseases of peanut. United State Department of Agriculture Year Book, 1953, 448-449.
4. Sahana NB, Sanath VB, Thejesha AG. Morphological and cultural studies of *Sclerotium rolfsii* sacc., causing foot rot disease of tomato. International Journal of Current Microbiology and Applied Sciences. 2017; 6(3):1146-1153.
5. Devangan PK, Koma B, Baghel S, Khare N, Singh HK. Characterization of *Pseudomonas fluorescens* in different media and its antagonistic effect on phytopathogenic fungi, The Bioscan. 2014; 9(1):317-321.
6. Kushwaha SK, Kumar S, Chaudhary B. Efficacy of *Trichoderma* against *Sclerotium rolfsii* causing collar rot disease of lentil under *in vitro* conditions. Journal of Applied and Natural Science. 2018; 10(1):307-312.
7. Suryawanshi AP, Borgaonkar AS, Kuldhar DP, Dey U. Integrated management of collar rot (*Sclerotium rolfsii*) of brinjal (*Solanum melongena*). Indian Phytopath. 2015; 68(2):189-195.