International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 1147-1149

Received: 04-07-2019
Accepted: 08-08-2019

Efficacy of systemic fungicides against *Sclerotium rolfsii* causing chickpea collar rot

AS Rothe, VG Mulekar, PN Kadam, KL Jaiswal and PA Shinde

AS Rothe
Department of Plant Pathology, College of Agriculture, Latur, Maharashtra, India

VG Mulekar
Department of Plant Pathology, College of Agriculture, Latur, Maharashtra, India

PN Kadam
Department of Plant Pathology, College of Agriculture, Latur, Maharashtra, India

KL Jaiswal
Department of Plant Pathology, College of Agriculture, Latur, Maharashtra, India

PA Shinde
Department of Plant Pathology, College of Agriculture, Latur, Maharashtra, India

Correspondence
AS Rothe
Department of Plant Pathology, College of Agriculture, Latur, Maharashtra, India

Abstract
Collar rot of chickpea caused by *Sclerotium rolfsii* has a major constraint and potential threat to successful chickpea cultivation. Therefore efforts were made to evaluate the different systemic fungicides *in vitro* condition against *Sclerotium rolfsii*. Seven systemic fungicides were evaluated (@ 500, 1000 and 1500 ppm) *in vitro* against *S. rolfsii* by poison food technique. However, 100% mycelial inhibition was recorded with difenconazole 25% EC, hexaconazole 5% EC, propiconazole 25% EC, tebuconazole 25.9 EC. These were followed by pyraclostrobin 20 WG (76.05%), carbendazim 50% WP (56.13%) and the fungicide thiophanate methyl 70% WP was found comparatively less effective with 18.49 per cent inhibition, of the test pathogen.

Keywords: Chickpea, systemic fungicides, poison food technique, *Sclerotium rolfsii*

Introduction
Chickpea (*Cicer arietinum* L.) is the world's third most important pulse crop after dry beans (*Phaseolus vulgaris* L.) and dry peas (*Pisum sativum* L.) (Vishwa Dhar and Gurha, 1998) [11]. Chickpea is a vital source of plant derived edible protein in many countries. It has advantages in the management of soil fertility, particularly in dry lands and the semiarid tropics. Indian subcontinent accounts for 90% of the total world chickpea production (Jalan *et al.*, 2000) [4]. Chickpea is contributing nearly 42 to 47 per cent of total pulse production in India. Nearly 90 per cent of the area and production is from six states *viz*., Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh, Karnataka and Andhra Pradesh (Arunodhayam *et al.*, 2014) [3]. In India, Chickpea is grown for *dal* making, culinary and for table purpose. It constitutes the main source of protein and several amino acids therefore, it is useful diet for human being. A legume crop fixes atmospheric nitrogen and thus helps to improve the soil fertility and has significant role in crop rotation. There are many reasons for low yield of chickpea such as lack of appropriate technology, use of local varieties, absence of irrigation facilities, growing of chickpea crop on marginal lands and pests and disease problems etc. Amongst them, diseases play an important role in reducing the yield potential of chickpea. Out of total diseases, collar rot causing a serious loss in chickpea production. Yield losses caused by collar rot of chickpea is 14-74% (Muthusamy and Mariappan, 1991) [6]. Chickpea collar rot is most serious and challenging disease which causes severe yield losses i.e. 60-70% under favourable conditions (Nene, 1985). *S. rolfsii* is soil borne pathogen and survives in soil for many years (Allce, 1984) [1]. Considering these issues, present study was planned and conducted with the aim to evaluate the different systemic fungicides *in vitro* condition against *Sclerotium rolfsii* causing collar rot of chickpea.

Material and Methods
Efficacy of seven systemic fungicides were evaluated under *in vitro* conditions by applying poison food technique (Nene and Thapliyal, 1993) [8]. The required quantity of respective fungicide was incorporated in 100 ml of PDA in 250 ml flasks. The medium was shaken well to give uniform dispersal of the fungicides. Seven systemic fungicides carbendazim, hexaconazole, difenconazole, propiconazole, tebuconazole, pyraclostrobin and thiophanate methyl, were evaluated at concentration of 500, 1000 and 1500 ppm against *S. rolfsii.* Twenty ml medium was poured separately into each sterilized Petri plates, replicated three times and centrally inoculated with 5 mm mycelial disc of the pathogen and incubated at 28±2 ^{0}C for seven days. A suitable control was maintained by growing the pathogen on fungicides free PDA medium. Observation on radial mycelial growth / colony diameter of the *S. rolfsii* was

recorded at an interval of 24 hours and continued till untreated control plates were fully covered with mycelial growth. Per cent mycelial growth inhibition of the pathogen with the test fungicides over the untreated control was calculated by using the formula (Vincent, 1927) [1].

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

Where,
C = Growth of the test fungus in untreated (control) plates.
T = Growth of the test fungus in treated plates.

Results and Discussion

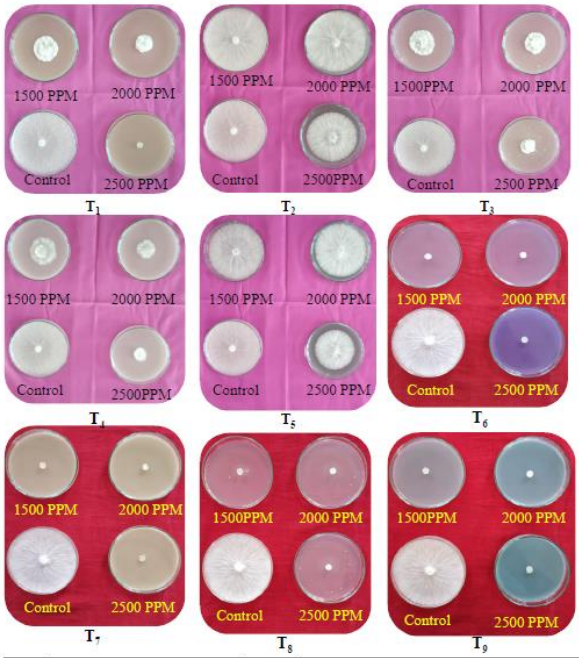
All seven systemic fungicides evaluated *in vitro* (each @ 500, 1000 and 1500 ppm) were found to influence significantly mycelial growth and its corresponding inhibition of *S. rolfsii*. (Plate I). Further, mycelial growth and its inhibition were found inversely and directly proportional, respectively to concentrations of the fungicides tested.

Radial mycelial growth

Results (Plate I, Table 1) revealed that the systemic fungicides exhibited a wide range of radial mycelial growth of *S. rolfsii*., and it was found to be decreased steadily with increase in concentrations of the test fungicides. However, difenconazole 25% EC, hexaconazole 5% EC, propiconazole 25% EC, and tebuconazole 25.9 EC at all three test concentrations of 500, 1000 and 1500 ppm showed none of mycelial growth of the test pathogen. This was followed by pyraclostrobin 20 WG (27.66 mm, 23.9 mm and 13.08 mm), carbendazim 50% WP (59.33 mm, 34.41 mm and 30.66 mm), and thiophanate methyl 70% WP (83.58 mm, 73.33 mm and 63.16 mm), respectively @ 500, 1000 and 1500 ppm, as against maximum mycelial growth (90.00 mm) with untreated control. Average radial mycelial growth recorded with the test systemic fungicides ranged from 0.00 mm to 73.35 mm. However, it was nil with fungicides difenconazole 25% EC, hexaconazole 5% EC, propiconazole 25% EC and tebuconazole 25.9 EC. These were followed by pyraclostrobin 20 WG (21.54 mm), carbendazim (41.46 mm) and thiophanate methyl 70% WP (73.35 mm) as against 90.00 mm with untreated control.

Mycelial growth inhibition

Results (Plate-I, Table 1) revealed that the systemic fungicides tested (each @ 500, 1000 and 1500 ppm) significantly inhibited mycelial growth of *S. rolfsii*, over untreated control and it was directly proportional to concentrations of the test fungicides. However, mycelial growth inhibition was cent per cent (100%) with difenconazole 25% EC, hexaconazole 5% EC, propiconazole 25% EC, and tebuconazole 25.9 EC at all three concentrations of 500, 1000 and 1500 ppm. This was followed by pyraclostrobin 20 WG (69.26%, 73.74% and 85.46%), carbendazim 50% WP (40.7%, 61.76% and 65.93%), and thiophanate methyl 70% WP (7.13%, 18.52% and 29.82%), respectively @ 500, 1000 and 1500 ppm, as against minimum mycelial inhibition (0.00 mm) with untreated control.



Tr. No.	Treatments	Tr. No.	Treatments
T_1	Mancozeb 75 WP	T_6	Carboxin 37.5% + Thiram 37.5% DS
T_2	Copperoxy chloride 50 WP	T_7	Metalaxyl 4% + Mancozeb 64% WP
T_3	Propineb 70 WP	T_8	Tebuconazole 50%+ Trifloxystrobin 25%
T_4	Chlorothalonil 75 WP	T_9	Carbendazim 25% + Mancozeb 50% WP
T_5	Copper hydroxide 77 WP	T_{10}	Control (untreated)

Plate I: *In vitro* efficacy of systemic fungicides against *S. rolfsii*, causing collar rot of chickpea.

Table 1: *In vitro* efficacy of systemic fungicides against *S. rolfsii* causing collar rot of chickpea

Tr. No	Treatments	Col. Dia.* (mm) at ppm			Av. (mm)	% Inhibition* at ppm			Av. Inhib. (%)
		500	1000	1500		500	1000	1500	
T_1	Carbendazim 50 WP	59.33	34.41	30.66	41.46	40.71(39.64)	61.76(51.80)	65.93(54.28)	56.13(48.52)
T_2	Difenconazole 25 EC	0.00	0.00	0.00	0.00	100.00(90.00)	100.00(90.00)	100.00(90.00)	100.00(90.00)
T_3	Hexaconazole 5 EC	0.00	0.00	0.00	0.00	100.00(90.00)	100.00(90.00)	100.00(90.00)	100.00(90.00)
T_4	Propiconazole 25EC	0.00	0.00	0.00	0.00	100.00(90.00)	100.00(90.00)	100.00(90.00)	100.00(90.00)
T_5	Tebuconazole 25.9 EC	0.00	0.00	0.00	0.00	100.00(90.00)	100.00(90.00)	100.00(90.00)	100.00(90.00)
T_6	Pyraclostrobin 20 WG	27.66	23.9	13.08	21.54	69.26(56.32)	73.44(58.97)	85.46(67.58)	76.05(60.69)
T_7	Thiophante methyl 70WP	83.58	73.33	63.16	73.35	07.13(15.48)	18.52(25.48)	29.82(33.09)	18.49(25.46)
T_8	Control (untreated)	90.00	90.00	90.00	90.00	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
	SE ±	0.37	0.27	0.21	-	0.47	0.28	0.33	-
	CD (P=0.01)	1.09	0.78	0.63	-	1.40	0.82	0.96	-

*- Mean of three replications, Figures in parentheses are arcsine transformed values

Average mycelial growth inhibition recorded with the systemic fungicides ranged from 18.49 to 100.00 per cent. However, it was significantly highest and cent per cent (100%) with difenconazole 25% EC, hexaconazole 5% EC, propiconazole 25% EC, tebuconazole 25.9 EC, followed by pyraclostrobin 20 WG (76.05%), carbendazim (56.13%) and thiophanate methyl 70% WP (18.49%) as against (0.00) mm with untreated control.

Thus, all of the seven systemic fungicides tested were found fungistatic against *S. rolfsii*. and significantly inhibited its mycelial growth, over untreated control. However, fungicides found most effective in their order of merit were difenconazole 25% EC, hexaconazole 5% EC, propiconazole 25% EC, tebuconazole 25.9 EC, pyraclostrobin 20% WG, carbendazim 50% WP, and thiophanate methyl 70% WP. Similar fungistatic effects of systemic fungicides against *S. rolfsii* were reported by Salvi *et al.* (2017) [9] and they revealed that complete inhibition of *S. rolfsii* with hexaconazole, propiconazole and difenconazole. These results are also in conformity to the reports of several earlier workers (Kuldhar and Suryawanshi, 2017; Wavare *et al*., 2017 and Archana *et al*., 2018) [5, 12, 2].

References

1. Allce D. Studies on antifungal properties of some plant extract. M.sc (Agri.) Thesis submitted to the (unpub.), TNAU, Coimbtore, 1984, pp.93.
2. Archana TS, Deore PB, Jagtap SD, Patil BS. *In vitro* evaluation of fungicides and bioagents against root rot of chilli caused by *Sclerotium rolfsii* Sacc., Int. J. Pure App. Biosci. 2018; 6(1):982-986.
3. Arunodhayam K, Reddy E, Reddy NP, Madhuri V. Pathogenicity and management of *Fusarium* wilt of chickpea *Cicer arietinum* L. A review. Current Biotica. 2014; 7(4):343-358.
4. Jalan A, Navas-cortes JA, Hau B, Jimenez-Diaz RM. Yield losses in chickpea in relation to development of *fussarium* wilt epidemics. Indian Phytopath. 2000; 90(11):1269-1278.
5. Kuldhar DP, Suryawanshi AP. Integrated management of stem rot and pod rot (*Sclerotium rolfsii*) of groundnut (*Arachis hypogaea* L.). Agric. Update. 2017; 12(techsear-1):238-246.
6. Muthusamy S, Mariappan V. Disintegration of Sclerotia of *Macrophomina phaseolina* (Soybean isolate) by oil cake extracts. Indian Phytopath. 1991; 44:271-273.
7. Nene YL. Opportunities for research on diseases of pulse crop. Indian Phytopath. 1985; 38:1-10.
8. Nene YL, Thapliyal PN. Evaluation of fungicides in plant disease controls (3rd ed.). Oxford, Ibh Publishing Co. New Delhi. 1993, pp.531-532.
9. Salvi PP, Pande VS, Pawar SV, Joshi PV. Effect of different fungicides and bio control agents against *Sclerotium rolfsii* Sacc. causing collar rot and root rot of pigeon pea under *in vitro* condition. Int. J. Chem. Sci. 2017; 5(6):1494-1496.
10. Vincent JM. Distortion of fungal hypha in the presence of certain inhibitors. Nature. 1927; 159:850.
11. Vishwa Dhar, Gurha SN. Integrated Management of chickpea diseases in Integrated pest and disease management. (eds. Rajeev, K., Upadhyay, K. G., Mukerji, B. P., Chamola and Dubey, O. P) ABH Publishing Co., New Delhi (India). 1998, pp.249.
12. Wavare SH, Gade RM, Shitole AV. Effect of plant extracts, bio agents and fungicides against *Sclerotium rolfsii* causing collar rot in chickpea. Indian J. Pharm. Sci. 2017; 79(4):513-520.