Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 2697-2701
Received: 15-03-2019
Accepted: 17-04-2019

Mukesh Amrutlal Katediya
M.Sc. Student, Department of Plant Pathology, C.P. College of Agriculture, S.D. Agricultural University, Sardar Krushi Nagar, Banaskantha, Gujarat, India

Rakesh Kumar Jaiman
Associate Professor, College of Horticulture, S.D. Agricultural University, Jagudan, Mehsana, Gujarat, India

Sanjay Kumar Acharya
Assistant Professor, College of Horticulture, S.D. Agricultural University, Jagudan, Mehsana, Gujarat, India

Correspondence
Rakesh Kumar Jaiman
Associate Professor, College of Horticulture, S.D. Agricultural University, Jagudan, Mehsana, Gujarat, India

Management of chilli anthracnose caused by *Colletotrichum capasici*

Mukesh Amrutlal Katediya, Rakesh Kumar Jaiman and Sanjay Kumar Acharya

Abstract
Chilli is one of the most important spices and vegetable crop of India, Chilli is susceptible to various fungal diseases such as Anthracnose, Damping off, Fusarium wilt, collar rot, dry root rot, stem rot and powdery mildew. Among of these, Anthracnose is the most widespread and important disease. Effects of cow urine were tested by poisoned food technique *in vitro* to know their inhibitory effect on the growth of anthracnose pathogen. Sterilized and unsterilized cow urine at 5, 10 and 20 per cent concentration showed per cent growth inhibition of *C. capsici.* The growth inhibition increase with increase in concentration cow urine. An inhibition of >40% was observed at 5%, >50% was observed at 10% and 20% concentrations in sterilized cow urine. The highest inhibition growth (91.67%) was observed against 20 per cent concentration and 15 days fermented. Sterilized cow urine was more effective then unsterilized cow urine. In unsterilized cow urine the highest inhibition growth (68.20%) was observed against 20 per cent concentration and 15 days fermented. Four systemic, three non-systemic and four combined fungicides at different concentrations were tested *in vitro* against *C. capsici* through poisoned food technique. Among the systemic fungicides, the completely growth inhibition of the fungus was recorded in difenaconazole and propiconazole at 500 and 1000 ppm concentrations. The next best systemic fungicide was pyraclostrobin at 1000 ppm inhibited 100 per cent mycelial growth. Among the non-systemic fungicides, the completely growth inhibition of the fungus was recorded in copper oxychloride at 1000, 1500, 2000 and 2500 ppm and mancozeb at 2500 ppm concentrations. The least effective fungicide was chlorothalonil at 1000, 1500, 2000 and 2500 ppm concentrations. Among the combined fungicides, the completely growth inhibition of the fungus was recorded in captan 70% + hexaconazole and carbendazim 12% + mancozeb 64% at all the concentrations. The next best combined fungicide were Pyraclostrobin 85g/ L + Epoxiconazole 62.5g/L and Zineb 68% + Hexaconazole 4% completely inhibited per cent mycelial growth at 500 and 1000 ppm concentration. Five different fungicides, 2 SAR activator and 2 organic inputs were tested for the management of anthracnose disease of chilli under field conditions. Difenconazole (0.025%) was significantly superior over rest of the fungicides, which was recorded the minimum disease intensity of 21.13 per cent with highest fruit yield. Copper oxychloride (0.2%) found second better fungicide for controlling the disease with 26.80 per cent disease intensity, which was at par with propiconazole (0.025%) and carbendazim + mancozeb (0.2%) in controlling the disease with 28.32 and 29.88 per cent disease intensity.

Keywords: Fungicides, cow urine, chilli, anthracnose, *Colletotrichum capsici*

1. Introduction
Chill **(***Capsicum annum*) is an important spice as well as vegetable crop in the world and India is one of the leading producers and exporters of chilli in the world. Several fungal, bacterial and viral diseases are reported to attack chilli (Nakkeeran *et al.*, 2006) [9]. Anthracnose disease in chilli is one of the most important limiting factors of chilli production worldwide, especially in tropical and sub-tropical regions which cause both quantitative and qualitative yield loss (Than *et al*., 2008) [14]. Anthracnose causes yield loss up to 50% in India (Sharma *et al*., 2005) [12]. Cultural methods, biological control, application of chemical fungicides and use of resistant cultivars are amongst the effective disease control measures that have been employed to control chilli anthracnose (Than *et al*., 2008) [14]. Although the management of anthracnose disease is still being extensively researched, commercial cultivars of *C. annum* that are resistant to anthracnose have not yet been developed. Use of fungicides appears to be the most practical measure for management of anthracnose disease. However, fungicide resistance often develops quickly, upon consistent usage of a single compound. The fungicide recommended for management of chilli anthracnose is manganese ethylenebisdithiocarbamate (Maneb), although it does not consistently control the severe form of the disease (Smith 2000) [13]. The strobilurin fungicides azoxystrobin (Quadris), trifloxystrobin (Flint) and pyraclostrobin (Cabrio) have recently been recommended for the control of anthracnose of chilli, but only preliminary reports are available on efficacy of these fungicides against severe form of the

disease. Hence, the present investigation was carried out to assess the effect and efficacy of cow urine and fungicides against chilli anthracnose.

The objective of present research work is to study the effect of cow urine, different fungicides with SAR activators in vitro and in field condition for management of chilli anthracnose with an aim to develop a safe and effective product against chiili anthracnose.

2 Materials and method

2.1 Pathogen Culture

Anthracnose affected chilli fruit, twigs and stem were collected from farmers 'field. Pathogen was isolated from anthracnose lesions of disease affected plant parts or fruits and cultured on PDA.

2.2Efficacy of cow urine against *Colletotrichum capsici in vitro*

Inhibition study was conducted *in vitro* to find out comparative efficacy of cow urine against chilli anthracnose pathogen. Fresh, 5, 10 and 15 day fermented, sterilized and unsterilized cow urine was tested by poison food technique and using PDA as a medium. Fermented cow urine was tested at 5, 10 and 20% concentrations. To maintain the desire concentration, required quantity of cow urine were added to respective flasks of sterilized medium at the time of pouring the medium in the plates. The cow urine was mixed thoroughly with medium by shaking well. Twenty ml of cow urine mixed medium was poured in each sterilized petri plates and allow solidifying. Petri plates without cow urine were served as control. After solidification, each petri plates was inoculated centrally by placing 7 days old fungal disc of 4 mm diameter and then incubated at 27±2°C temperature for 7 days. Four replications were maintained. Observation on radial mycelia growth of fungus was recorded and per cent growth inhibition in each treatment was calculated by using following formula (Asalmol *et al*., 1990) [1].

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

Where,
I = Per cent growth inhibition
C = Growth in control (mm)
T = Growth in treatment (mm)

2.3 Efficacy of fungicides against *Colletotrichum capsici in vitro*

Inhibition study was conducted *in vitro* to find out comparative efficacy of different fungicides against of chilli anthracnose. Systemic, non-systemic and combined fungicides were tested against of chilli anthracnose by poison food technique and using PDA as a medium. Systemic, non-systemic and combined fungicides were tested at different concentrations, on the basis of active ingredient. To maintain the desired concentration, required quantity of fungicides were added to respective flasks of sterilized medium at the time of pouring the medium in the plates. The fungicides were mixed thoroughly with medium by shaking well. Twenty ml of fungicidal mixed medium was poured in each sterilized petri plates and allow solidifying. Petri plates without fungicides were served as control. After solidification, each petri plates was inoculated centrally by placing 7 days old fungal disc of 4 mm diameter and then incubated at 27±2°C temperature for 7 days. Three replications were maintained. Observation on radial mycelial growth of fungus was recorded and per cent growth inhibition in each treatment was calculated by using following formula (Asalmol *et al*., 1990) [1] as described in cow urine experiment.

2.4 Evaluation of fungicide and SAR activator against anthracnose disease of chilli in field condition

A field trial was conducted at Agricultural Instructional Farm, C. P. college of Agriculture, S.D. Agricultural University, Sardar krushi nagar (Dantiwada) Gujarat during *Kharif* 2018 to determine the efficacy of two systemic, two non-systemic, one compound fungicide with two SAR and two organic product in controlling chilli anthracnose. The first foliar spray were given immediately after first appearance of disease symptoms followed by two sprayings at 15 days interval. The cultivar, Gujarat Chilli 3 (GCh 3) was used in the field trials. The trials were laid out in a randomized block design (RBD) with ten treatments and three replications with a plot size of 5.40 X 6.00 $m^2$and with a spacing of 90 x 60 cm. The recommended package of practices were followed to cultivate the chilli crop. The average per cent disease incidence from 20 plants of anthracnose was worked out by using following 0-9 scale formula (Mayee and Datar, 1986) [8]. The disease incidence was worked out as below to calculate per cent disease index by using following formula (Wheeler, 1969) [15].

$$PDI = \frac{\text{Total sum of numerical rating}}{\text{Number of fruits/leaves observed} \times \text{Maximum grade value}} \times 100$$

Where,
PDI = Per cent disease incidence
0 = No infection
1 = 1-10% infection
3 = 11-25% infection
5 = 26-50% infection
7 = 51-75% infection
9 = > 75% infection

3 Result and Discussion

3.1 Efficacy of cow urine against *Colletotrichum capsici in vitro*

The result of antifungal effect of sterilized cow urine against *Colletotrichum capsici* is presented in Table 1 and 2. Cow urine concentration inhibitedthe test fungus. The growth inhibition increase with increase cow urine in concentration. An inhibition of>40 per cent was observed at 5 per cent, >50per cent was observed at 10 per cent and 20 per cent concentrations in sterilized cow urine. The highest growth inhibition (91.67%) was observed against 20 per cent cow urine concentration which was 15 days fermented.Unsterilized cow urine was not more effective then sterilized cow urine. The highest growth inhibition (68.20%) was observed against 20 per cent concentration and 15 days fermented (Table 2). Similar results have also been presented by Kambar *et al*., (2013) [7] with an aim to determine antifungal efficacy of cow urine against *Colletotrichum capsici* isolated from anthracnose of chilli (*Capsicum annum* L.). Poisoned food technique was employed to determine antifungal activity of different concentrations of cow urine (5, 10 and 15%). An inhibition of *Colletotrichum capsici*> 50 per cent was observed at 5per cent concentration and > 75 per cent inhibition was observed at cow urine concentration 10 and 15 per cent. Ashlesha and Paul (2014)[2]showed

fermented cow urine maximum 100 and 99 per cent inhibition in the mycelial growth of the *C. capsici*, *Phytophthora nicotianae*, *Sclerotium rolfsli*, *Fusarium oxysporum* f.sp. *capsici* at 10 per cent fermented cow urine.

Table 1: Effect of sterilized cow urine on growth inhibition of *Colletotrichum capsici in vitro*

Sr. No.	Cow urine	Concentrations (%) #			
		Sterilized cow urine			
		5	10	20	Mean
1	5 day fermented	43.30 h (46.57) *	51.04 f (60.00)	51.80 e (61.55)	48.71 (56.04)
2	10 day fermented	45.75 g (50.85)	52.10 e (61.80)	53.61 d (64.35)	50.49 (59.00)
3	15 day fermented	54.52 c (65.85)	61.45 b (76.70)	73.75 a (91.67)	63.24 (78.07)
Mean		47.86 (54.41)	54.86 (66.16)	59.72 (72.52)	-
Cow urine		0.175			
Concentrations		0.175			
Cow urine × Concentrations		0.304			
S.Em.±					
C.V. %		1.12			

* Figures in parenthesis are retransformed values
# Means followed by common letter(s) are not significant by Duncan's New Multiple Range test at 5 per cent level of significance.

Table 2: Effect of unsterilized cow urine on growth inhibition of *Colletotrichum capsici in vitro*

Sr. No.	Cow urine	Concentrations (%) #			
		Unsterilized cow urine			
		5	10	20	Mean
1	5 day fermented	32.77 g (28.82)*	38.40 f (38.12)	47.37 d (53.67)	39.51 (40.20)
2	10 day fermented	37.59 f (36.85)	43.70 e (47.27)	50.00 c (58.22)	43.77 (47.44)
3	15 day fermented	46.60 d (52.32)	53.62 b (64.35)	55.96 a (68.20)	52.06 (61.62)
Mean		38.99 (39.33)	45.24 (49.91)	51.11 (60.03)	-
Cow urine		0.276			
Concentrations		0.276			
Cow urine × Concentrations		0.478			
S.Em.±					
C.V. %		2.12			

* Figures in parenthesis are retransformed values
# Means followed by common letter(s) are not significant by Duncan's New Multiple Range test at 5 per cent level of significance.

3.2 Efficacy of fungicides against *Colletotrichum capsici in vitro*

Four systemic, three non-systemic and four combined fungicides at different concentrations were tested *in vitro* for their comparative efficacy against *C. capsici* through poisoned food technique. The results presented in Table 3 revealed that all the four systemic fungicides at different concentrations (100, 250, 500 and 1000 ppm) found promising against anthracnose fungus. Complete growth inhibition of the fungus was recorded in difenaconazole and propiconazole at 500 and 1000 ppm concentrations. The next best systemic fungicide was pyraclostrobin at 1000 ppm inhibited 100 per cent mycelial growth. The inhibitory effect of all the systemic fungicides increased with the increasing concentrations of the fungicides. Non-systemic fungicides at different concentrations (1000, 1500, 2000 and 2500 ppm) found promising against anthracnose fungus except chlorothalonil The complete growth inhibition of the fungus was recorded in copper oxychloride at 1000, 1500, 2000 and 2500 ppm and mancozeb at 2500 ppm concentrations. Inhibitory effect of all the non-systemic fungicides increased positively with the increasing concentrations of the fungicides (Table 4). The results presented in Table 5 revealed that all the four combined fungicides at different concentrations (100, 250, 500and 1000 ppm) found promising against anthracnose fungus. The complete growth inhibition of the fungus was recorded in captan 70% + hexaconazole 5% and carbendazim 12% + mancozeb 64% at all the concentrations. While fungicide pyraclostrobin 85g/ L + epoxiconazole 62.5g/L and zineb 68% + hexaconazole 4% completely growth inhibition at 500 and 1000 ppm concentration. The inhibitory effect of all the combined fungicides increased with the increasing concentrations of the fungicides.Similar results have also been presented by Deshmukh *et al*. (2002) [5] tested the efficacy of mancozeb and zetron under *in vitro* condition. They reported that there was no growth of *C. capsici* in 0.25% mancozeb. Zetron significantly reduced fungus growth at various concentrations. Five systemic fungicides (carbendazim, propiconazole, difenconazole, dimethomorph and thiophanate methyl) at concentration of 50, 100, 250, 500 and 1000 ppm, five non systemic fungicides (chlorothalonil, mancozeb, propineb, copper oxychloride and copper hydroxide) at concentration of 500, 1000, 1500, 2000 and 3000 ppm and three compound (metalaxyl 8 WP + mancozeb 64 WP, carbendazim 12WP + mancozeb 63 WP and carboxin 37.5 WP + thirum 37.5 WP) at concentration of 250, 500, 1000, 1500 and 2000 ppm were evaluated against *C. capsici* under *in vitro* condition. The results indicated that all the fungicides

among them, carbendazim and propiconazole at 50 to 1000 ppm, copper oxychloride at 500 to 3000 ppm andcarbendazim + mancozeb at 250 to 2000 ppm concentration completely inhibited the growth of fungus (Chauhan. 2010) [3].

Table 3: Effect of systemic fungicides on growth inhibition of *Colletotrichum capsici in vitro*

Sr. No.	Fungicides	Concentrations (ppm)#				
		100	250	500	1000	Mean
1	Propiconazole	46.89[g] (52.80)*	52.67[d] (62.80)	89.39[a] (100)	89.39[a] (100)	69.58 (78.9)
2	Difenconazole	42.61[h] (44.70)	50.47[e] (59.03)	89.39[a] (100)	89.39[a] (100)	67.96 (75.93)
3	Pyraclostrobin	39.87[j] (40.60)	49.37[f] (57.10)	57.12[c] (70.00)	89.39[a] (100)	58.93 (66.92)
4	Azoxystrabin	40.74[i] (42.10)	42.43[h] (45.00)	42.55[h] (45.20)	67.75[b] (85.20)	48.37 (54.37)
Mean		42.53 (45.05)	48.74 (52.98)	69.61 (78.8)	83.98 (96.3)	-
Fungicides		0.171				
Concentrations		0.171				
Fungicides × Concentrations		0.341				
S.Em.±						
C.V. %		0.96				

* Figures in parenthesis are retransformed values
# Means followed by common letter(s) are not significant by Duncan's New Multiple Range test at 5 per cent level of significance.

Table 4: Effect of non-systemic fungicides on growth inhibition of *Colletotrichum capsici in vitro*

Sr. No.	Fungicides	Concentrations (ppm)#				
		1000	1500	2000	2500	Mean
1	Copper oxychloride	89.39[a] (100)*	89.39[a] (100)	89.39[a] (100)	89.39[a] (100)	89.39 (100)
2	Chlorothalonil	10.27[h] (2.70)	13.85[g] (5.10)	15.97[f] (6.80)	17.59[e] (8.60)	14.42 (5.8)
3	Mancozeb	55.66[d] (67.70)	62.63[c] (78.40)	72.61[b] (90.60)	89.39[a] (100)	70.07 (84.17)
Mean		51.77 (56.80)	55.29 (61.16)	59.32 (65.80)	65.45 (69.53)	-
Fungicides		0.119				
Concentrations		0.137				
Fungicides × Concentrations		0.237				
S.Em.±						
C.V. %		0.985				

*Figures in parenthesis are retransformed values
Means followed by common letter(s) are not significant by Duncan's New Multiple Range test at 5 per cent level of significance.

Table 5: Effect of combined fungicides on growth inhibition of *Colletotrichum capsici in vitro*

Sr. No.	Fungicides	Concentrations (ppm)#				
		100	250	500	1000	Mean
1	Pyraclostrobin 85 + Epoxiconazole 62.5g/L	67.32[c] (84.60)*	69.36[b] (87.10)	89.39[a] (100)	89.39[a] (100)	78.86 (92.92)
2	Carbendazim 12%+ Mancozeb 64% wp	89.39[a] (100)	89.39[a] (100)	89.39[a] (100)	89.39[a] (100)	89.39 (100)
3	Captan 70% + Hexaconazole 5% wp	89.39[a] (100)	89.39[a] (100)	89.39[a] (100)	89.39[a] (100)	89.39 (100)
4	Zineb 68% + Hexaconazole 4% wp	55.20[e] (66.90)	56.36[d] (68.80)	89.39[a] (100)	89.39[a] (100)	72.58 (86.92)
Mean		75.32 (87.87)	76.12 (88.97)	89.39 (100)	89.39 (100)	-
Fungicides		0.197				
Concentrations		0.197				
Fungicides × Concentrations		0.395				
S.Em.±						
C.V. %		0.854				

*Figures in parenthesis are retransformed values
Means followed by common letter(s) are not significant by Duncan's New Multiple Range test at 5 per cent level of significance.

3.3 Evaluation of fungicide and SAR activator against anthracnose disease of chilli in field condition

Table 6 revealed that all thetreatments were effectively superior over control in checking the chillianthracnose disease. Among the fungicides, difenconazole (0.025%) was significantly superior over rest of the fungicides, which was recorded the minimum disease intensity of 21.13 per cent. Copper oxychloride (0.2%) found second better fungicide for

controlling the disease with 26.80 per cent disease intensity, which was at par with propiconazole (0.025%) and carbendazim + mancozeb (0.2%) in controlling the disease with 28.32 and 29.88 per cent disease intensity. The next best fungicide was mancozeb (0.2%) which was at par with cow urine (10%) with 31.56 and 33.31 per cent disease intensity. Between the two SAR activator salicylic acid (100 ppm) found better with 35.85 per cent disease intensity. The maximum per cent disease intensity (54.26%) was recorded in untreated control.All fungicides recorded higher yield as compared to control. Green chilli yield (2877 kg/ha) was obtained with the spraying of difenconazole (0.025%) followed by copper oxychloride at 0.2% per cent (2600 kg/ha), propiconazole (2543 kg/ha) and carbendazim + mancozeb (2485 kg/ha). Similar results have also been found by Rathore (2004) and he evaluated that score (0.05%) was the most effective fungicide in controlling anthracnose and restricted the per cent fruit rot incidence of chilli. Ekbote (2005)[6] recorded that the less per cent incidence of anthracnose and highest dry chilli pod yield in the treatment with emcop (0.20%) which was at par with emcop (0.15% and 0.10%), carbendazim (0.1%) and copper oxychloride (0.25%). Chauhan *et al*., (2014) [4] reported that the minimum anthracnose disease intensity with maximum fruit yield was found in carbendazim 0.05% which was statistically at par with 0.2% mancozeb, 0.2% carbendazim + mancozeb and 0.2% copper oxychloride. Sarkar *et al*. (2016) [11] reported that minimum anthracnose disease intensity with maximum fruit yield was found with difenconazole which was statistically at par with penconazole, tebuconazole and azoxystrobin.

Table 6: Effect of different fungicide and SAR activator against anthracnose disease of chilli in field condition

Sr. No.	Treatments	Concentration#	Per cent disease intensity (PDI)	Yield (kg/ha)
1	Difenconazole 25 EC	0.025%	27.65^{e}(21.13)*	2877^{a}
2	Propiconazole 25 EC	0.025%	32.42^{de} (28.32)	2543^{b}
3	Mancozeb 75 WP	0.2%	34.45^{cd} (31.56)	2313^{bcd}
4	Copper oxychloride	0.2%	31.47^{de} (26.80)	2600^{ab}
5	Carbendazim 12% + Mancozeb 64%	0.2%	33.42^{de} (29.88)	2485^{bc}
6	Salicylic acid	100 ppm	37.05^{bcd} (35.85)	2119^{de}
7	Isonicotinic acid	100 ppm	42.35^{ab} (44.93)	1785^{f}
8	Cow urine	10%	35.23^{cd} (33.31)	2200^{cde}
9	Vermiwash	10%	40.21^{bc} (41.17)	1916^{ef}
10	Control	-	47.77^{a} (54.26)	1463^{g}
S. Em. ±			1.89	95.41
C. V. %			9.09	7.41

*Figures in parenthesis are retransformed values

Means followed by common letter(s) are not significant by Duncan's New Multiple Range test at 5 per cent level of significance.

4. References

1. Asalmol MN, Sen, B, Awasthi J. Role of temperature and pH in antagonism of *Aspergillus niger* and *Trichoderma viride* against *Fusarium solani*. Proc. Indian Phytopath. Soc. (WZ) on Biocontrol of plant pathogen at College of Agriculture, Pune, 1990, 1-13.
2. Ashlesha, Paul YS. Antifungal bio efficacy of organic inputs against fungal pathogens of bell pepper. Paripex-Indian Journal of Research. 2014; 3(6):4-91.
3. Chauhan YB. Studies on anthracnose disease of chilli (*Capsicum annum* L.) caused by *Colletotrichum capsici* (Sydow) Butler and Bisby and its management. Thesis submitted to SDAU M.Sc. (Ag.) Pl. Path Thesis, Department of Plant Pathology, SD Agricultural University, Sardarkrushinagar, Gujarat, 2010.
4. Chauhan YB, Patel RL, Chaudhary RF, Rathod NK. Efficacy of different at fungicides for the management of chilli anthracnose caused by *Colletotrichum capsici*. The Bio scan. 2014; 9(1):399-402.
5. Deshmukh GP, Kurundkar BP, Mehetre NM. Efficacy of Zetron against *Colletotrichum capsici in vitro*. J. Maharashtra Agric. Univ. 2002; 27(1):62-63.
6. Ekbote SD. Evaluation of bio-rational fungicide Emcop SC (Shield) against die-back and fruit rot of chilli. J Mycol. Pl. Pathol. 2005; 35(2):283-285.
7. Kambar Y, Vivek MN, Manasa M, Prayith Kekuda TR, Noor Nawaz AS. Inhibitory effect of cow urine against *Colletotrichum capsici* isolated from anthracnose of chilli (*Capsicum annum* L.). 2013; 2(4):91-93.
8. Mayee CD, Datar VV. Phytopathoometry. Technical Bulletin-I. Marathawada Agricultural University, Parbhani, 1986.
9. Nakkeeran S, Kavitha K, Chandrasekar G, Renukadevi P, Fernando WGD. Induction of plant defense compounds by *Pseudomonas chlororaphis* PA23 and Bacillus subtillis BSCBE4 in controlling damping off of hot pepper caused by *Pythium aphanidermatum*. Biocontrol Sci Technol. 2006; 16:403-406.
10. Rathore BS. Evalution of bio-efficacy of myclobutanil against disease of chilli. J Mycol. Pl. Pathol. 2006; 36(1):74-76.
11. Sarkar S, Nandi A, Dash SK, Senapati N, Pandey G, Das S, Patnaik A. Bioefficacy of different fungicides along with bioagents against chilli anthracnose (*Colletotrichum capsici*) disease under field condition. J Mycopathol. Res. 2016; 54(1):85-87.
12. Sharma PN, Kaur M, Sharma OP, Sharma P, Pathania A. Morphological, pathological and molecular variability in *Colletotrichum capsici*, the cause of fruit rot of chillies in the subtropical region of north-western India. J. Phytopathol. 2005; 153:232-237.
13. Smith KL. Peppers. In: Precheur RJ (ED), Ohio Vegetable Production Guide. Ohio State University Extension, Columbus, Ohio, 2000, 163-173.
14. Than PP, Jeewon R, Hyde KD, Pongsupasam S, Mongkolporn O, Taylar PWJ. Characterization and pathogenicity of *Colletotrichum* species associated with anthracnose on chilli (*Capsicum spp*.) in Thialand. Plant Pathol. 2008; 51:562-572.
15. Wheeler BEJ. An introduction to Plant disease. John Willey and Sons Ltd., New York, 1969, 374.