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Characterization and management of *Cercospora* leaf spot of fenugreek (*Trigonella foenum-graecum* L.) caused by *Cercospora traversiana* through organic treatments

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Abstract

The mycelium growth diameter was observed in *Cercospora traversiana*. In case of 144 h, mycelium growth diameters were more or less similar on PDA and malt extract. Whereas, after 192 h of inoculation, mycelial growth was 90.0 mm on PDA, 87.5 mm on MEA and 16.5 mm on nutrient agar. The organic treatment brought about significant reduction in the days of first appearance of disease. The maximum reduction was in seed treatment with cow urine (76.0 days) and foliar spray of cow dung slurry (76.0 days). Seed with organic treatments were significantly decreased the per cent disease intensity in cow urine, cow dung slurry, panchagavya and Vanaspativash. The effect of foliar spray of organic treatment on per cent disease control was recorded maximum 21.69% and 21.41% in cow dung slurry at 10th and 12th week and minimum 4.64% and 7.13% in Vanaspativash + cow urine + cow dung slurry at 12th and 11th week, respectively. The yield was found highest in seed treatment with Vanaspativash (17.34 q/ha.), followed by seed treatment with cow urine (17.30 q/ha.), seed treatment with panchagavya (17.12 q/ha.) and foliar spray of cow dung slurry (16.85 q/ha.). It can be concluded that organic treatments, *viz.*, mixture of cow products such as cow urine, cow dung, cow dung slurry and other cow products with or without plant extracts have the growth promoting capacity along with induced systemic resistance (ISR) to diseases for the improved quality of plants products either through seed treatments or foliar spray as cheapest alternate input for higher net returns.

1. Introduction

The scientific name of fenugreek is (*Trigonella foenum-graecum* L.) is widely applied for the seed spice and cultivated for seed and leafy vegetable. It belongs to the family Leguminaceae and subfamily Papilionaceae (Mehranfarin *et al*., 2011). The new and soft leaves are rich in vitamins, protein, iron, calcium and essential amino acids. Moreover, this is a big medicinal value crop and hampers costiveness, removes indigestion and encourages process and metabolism. The fenugreek seeds are applied for the treatments of dysentery, diabetes, rickets and diarrhea. Fenugreek has neuroprotective, antimigraine, memory improving, antibacterial, antiviral and antitumor activities, because it contains a large amount of saponins, phenol, flavonoids and fibers that cause for many health fits (Yao *et al*., 2020). India is one of the chief producer and exporter of fenugreek seeds. Commercially, it is grown on large scale in Rajasthan, Gujarat, Uttar Pradesh, Madhya Pradesh and Uttarakhand. In India, fenugreek is grown on an area of 2, 11,110 hectares and producing 2, 99,870 tonnes of seeds (Agrawal *et al*., 2001; Suxena and Singh, 2019). Whereas in Uttar Pradesh, total production of fenugreek seeds during 2015-2016 was 218 metric tons from the area of 399 hectares and productivity 0.546 metric tons per hectare. Other countries producing large scale of fenugreek seeds such as China, East Africa, Argentina, North America, Australia and some part of Mediterranean Europe, *etc*. (Petropoulos, 2002; Anonymous, 2013). Due to large scale planting of the fenugreek crops tend to increase favourable climatic conditions for disease and insect incidence and seed yield of fenugreek (Prakash and Sharma, 2000). Even, the very scanty statements are achievable on its susceptibility against the fungal, bacterial, nematodes and other pathogens under the moist agroclimatic conditions (Basu *et al*., 2006). Amongst the disease of *Cercospora* leaf spot of fenugreek caused by (*Cercospora traversiana*) is reported as the mostly harmful disease which under the suitable environmental conditions for the pathogen can cause 80 per cent decrease in yield (Sillero *et al*., 2006). It is dire necessity to work extensively to examine the effect of cow products and botanically for controlling plant disease which is easily available with low cost for sound ecology and eco-friendly environment without any pollution. So, keeping in view of above, the experiment was undertaken with “Characterization and management of *Cercospora* leaf spot disease of fenugreek through organic treatments”.

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2. Materials and Methods

2.1 Evaluation of various media for characterization of mycelial growth

The experiment was operated under *in vitro* to find the mycelium growth of the associated pathogen causing *Cercospora* leaf spot of fenugreek. The 500 ml of each media were prepared, filled in 250 ml flask and sterilized separately. The media was supplemented with

streptomycin sulphate (50 ppm) to prevent bacterial contamination. Each media (20 ml) was separately poured in sterilized Petri plates in six replicates and allow solidify. The plates were then inoculated with five (5) mm diameter disc of 15 days old culture of *C. traversiana* by place in the centre of plate with the help of cork borer. The inoculated plates on incubated at 25 ± 2°C in B.O.D. Incubator. The observations of mycelial growth diameter (mm) were recorded every 48 h after inoculation. The per cent growth rate was calculated as the 48 h average of mean growth average (mm/h), method described by (Prasad *et al*., 2014; Nega *et al*., 2016).

2.2 Management of the disease

The field trial was operated in a randomized block design (RBD) with three (3) replications and 11 treatments including check during Rabi season 2016-2017. Experimental field trial plot size was 2 × 2.4 m^2, folksy six (6) rows with row-to-row distance 20 cm and plant-to-plant distance 10 cm. Fenugreek variety is Hisar sonali was sown @ 50 g seed/plot. The seeds were sown in lines and date on 30 November 2016. The layout of experiment detail is given below.

2.3 Treatments details

The treatments were used in experimental field trial is T1 seed treatment with cow urine @10%, T2 spray of cow urine @10%, T3 seed treatment with cow dung slurry @10%, T4 foliar spray of cow dung slurry @10%, T5 seed treatment with panchgavya@10%, T6 foliar spray of panchgavya@10%, T7 seed treatment with vanaspativash @10%, T8 foliar spray of vanaspativash @10%, T9 seed treatment with vanaspativash + cow dung slurry + cow urine @10%, T10 foliar spray of vanaspativash + cow dung slurry + cow urine @10% and T11 control.

2.4 Collection of cow dung and cow urine

We have collected cow dung and cow urine in steel bucket and plastic drum from a local and Sahiwal varieties of cow, college of Veterinary and Animal husbandry at Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya. The cow urine cleans through Whatman filter paper No.1 and muslin cloth (remove debris and solid materials) and stored in glass bottle and waterproof at 4°C temperature prior to use. The preparation of cow dung slurry with adds similar of pure and clean water (1:1 W/V).

2.5 Composition of panchagavya and vanaspativash

Take the fresh five (5) cow products like cow dung (3 kg), cow urine (3 l), cow milk (3 kl), cow curd (3 kg) and cow ghee (1 kg) was collected for the build of panchagavya. The panchagavya making want amount of five (5) cow products severely mixed in pot repository and then allow to fermentation for seven days with two churning per day (Chadha *et al*., 2012). Vanaspativash was prepared with using the materials, *viz.*, fresh 3.0 litre cow urine, 250 gm of fresh neem leaf, 250 gm fresh tulsi leaf, 250 gm fresh dhatura leaf, 250 gm fresh madar leaf, 250 gm fresh *Aloe vera* leaf, 100 gm jaggery and 100 gm besan.

2.6 Per cent disease intensity and PDC

Cercospora leaf spot disease was scored in the field at 9th standard week, 10th standard week, 11th standard week and 12th standard week in randomly selected six plants of each fenugreek plots. The percentages of leaves affected by disease were assessed visually in 0-5 point scale as given by reported Iqbal *et al*. (2011), Sharma *et al*. (2010).

Table 1: Disease scale (0-5)

Sl. No.	Severity grade	Disease per cent (%)
1	0	No plant leaves infection
2	1	1-15 % plant leaves infection
3	2	16-40 % plat leaves infection
4	3	41-65 % plant leaves infection
5	4	66-90 % plant leaves infection
6	5	91-100 % plant leaves infection

The per cent disease intensity (PDI) was calculated by the standard formula given by (Wheeler, 1969):

Per cent disease intensity (PDI) =

$$\frac{\text{Sum of all numerical value}}{\text{Total number of leaves examined} \times \text{maximum grade}} \times 100$$

Per cent disease control was calculated as per formula given by (Kushalappa and Ludwig, 1982).

$$\text{Disesese control (\%)} = \frac{C - T}{C} \times 100$$

where,

C is denoted per cent disease intensity in unprocessed plot (untreated).

T is denoted per cent disease intensity in manage plot (treated).

3. Results

The results revealed that the pathogen *C. traversiana* was isolated from the infected fenugreek leaves and then culture in potato dextrose agar media. The confirmation of *C. traversiana* was done on the basis of electron microscopic studies of conidia and conidiophores from the culture of pathogen. The characterization of *C. traversiana* was done through microscopic images (Figure 1). The colony of mycelia was seen is white cottony, paler gray, thin sector and slightly raised on upper underside with olivaceous. The colonies were circular in diameter with irregular margins. The *C. traversiana* conidiophores are dark, small conidial scare, raising in clusters, multicelled and unbranched rarely septate.

It is developed conidiophores in fascicles of 3 to 14 conidiophores per fascicles with length up to 16.95 to 30.80 µm and width ranging from 2.5 to 5.5 µm (Figure 2). Conidia is glossy, acicular, straight on slightly coil with round apex, a truncate base with multi-septate. Conidial length and width were measured by micrometer. The length was ranged from 2.2 to 3.5 µm and width was ranged from 1.2 to 1.85 µm (Figure 3).

3.1 Mycelium growth in different media

The effect of media on mycelium growth diameter of *C. traversiana* was studied and found significantly increased growth on PDA (30.67 mm), followed by malt extract (25.67 mm) and nutrient agar (6.50 mm) at 48 h after inoculation. After 96 h, the mycelium growth was 61.33 mm on PDA, 48.8 3 mm in malt extract and 9.5 mm on nutrient agar. In case of 144 h, mycelium growth diameters were more or less similar on PDA and malt extract. Whereas, after 192 h of inoculation, mycelial growth was 90.0 mm on PDA, 87.5 mm on

MEA and 16.5 mm on nutrient agar. Cow urine based potato dextrose agar media was not supported the mycelial growth of *C. traversiana* up to 192 h after inoculation. The increased rate of mycelium growth per hour was found highest on PDA media (0.63 mm), followed by malt extract agar media (0.53 mm) and nutrient agar media (0.13 mm) till the 48 h after inoculation. The increase growth rate was gradually decreasing in all growth media. The maximum decreasing growth rate was observed on PDA and minimum in nutrient agar media. Because of 192 h after inoculation, the growth rate was 0.46 mm on PDA, 0.45 mm on malt extract and 0.08 mm on nutrient agar media (Table 1).

Figure 1: Mycelial growth of *C. traversiana* PDA.

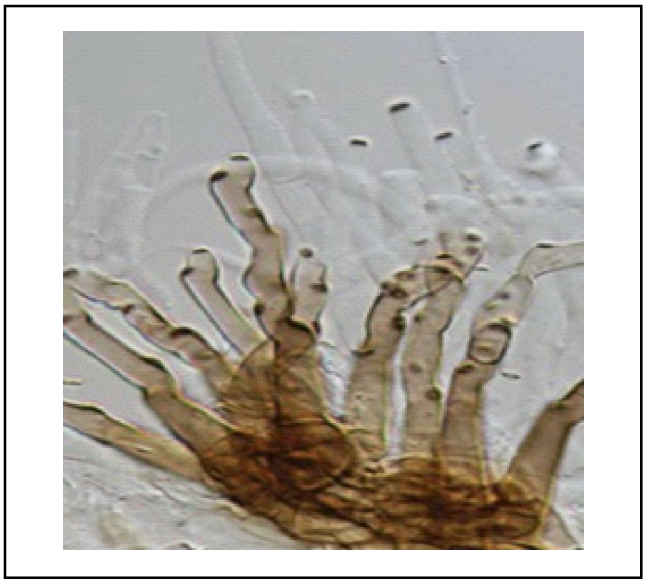

Figure 2: Conidia and conidiophores.

3.2 First appearance of disease and per cent disease intensity

The organic treatment brought about significant reduction in the days of first disease appearance. The decrease was maximum in treatment no one (76.0 days) and foliar spray of cow dung slurry (76.0 days), fallowed by foliar spray of cow urine (73.0 days), and seed treatment with cow dung slurry (73.67 days). The effects of other treatments on disease appearance were found effective, but it was not significant in comparison to control (68.75 days). Organic treatments of seeds gave significant reduction in per cent disease intensity. The maximum reduction of disease intensity was finding in seed treatments with cow urine (13.47%), followed by cow dung slurry (13.46%), panchagavya (14.15) and vanaspativash (13.46%) at 9th week of observation. In case of 10th week of observation, the maximum disease intensity was also recorded in cow urine (18.35%), cow dung slurry (18.69%) and panchagavya (18.81%). Whereas, at 11th standard week, the effect of seed treatment was not significant in cow dung slurry, panchagavya and vanaspativash, but found significant in cow urine, cow dung slurry and panchagavya at 12th standard week.

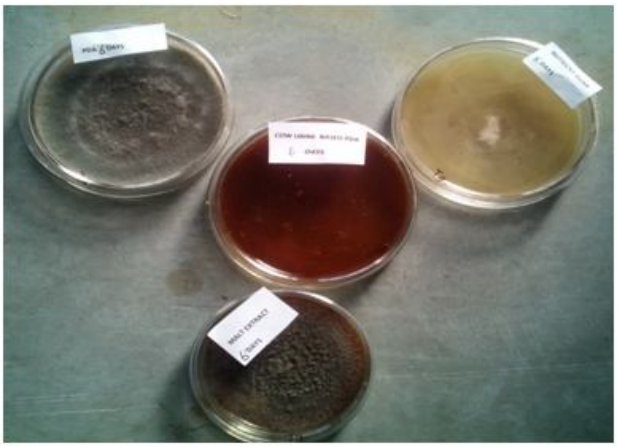

Figure 3: Mycelial growth in different media (PDA, malt extracts, NAM, cow urine based media).

Foliar spray of organic treatments were significantly decreased the per cent disease intensity in cow urine, cow dung slurry and vanaspativash. The decrease of per cent disease intensity was highest in cow urine (14.27%) and lowest in vanaspativash (15.25%) at 9th standard week. At 10th standard week, foliar spray of vanaspativash was greatly reduced the per cent disease intensity (18.06%), followed by cow urine (18.33%) and cow dung slurry (18.61%). In case of 11th week, the minimum disease intensity was recorded (24.83%) in cow urine, (25.26%) in panchagavya and (26.74%) in cow dung slurry. Whereas, at 12th week, the effect was maximum (33.47%) in cow urine, (35.15%) in cow dung slurry and (39.76%) in panchagavya. The reduction of per cent disease intensity among the organic treatment was not found significant (Table 2).

3.3 Per cent disease control

The organic treatments increased the per cent disease control in all the standard weeks. The enhanced per cent disease control was significant in cow urine and cow dung slurry. The per cent diseased control with seed treatment was highest (24.49%) in cow dung slurry, (24.33%) in cow urine, (23.26%) in vanaspativash and (20.93%) in panchagavya at 9th standard week. In case of 10th standard week, reduction of per cent diseased control was highest in treated seeds with panchagavya (27.84%), followed by vanaspativash (25.55%), cow urine (22.87%) and cow dung slurry (17.90%). At 11th standard week, the effect of seed treatment with vanaspativash for per cent disease control was maximum (15.69%), followed by cow dung slurry (15.09%) and cow urine (11.07%), whereas in 12th standard week, per cent disease control was highest (19.33%) in cow urine, (16.95%) in vanaspativash and (14.13%) in cow dung slurry. The effect of foliar spray of organic treatments on per cent disease control was

recorded maximum (21.69%) and (21.41%) in cow dung slurry at 10th and 12th week, respectively, and minimum (4.64%) and (7.13%) in vanaspativash + cow urine + cow dung slurry at 12th and 11th standard week, respectively (Table 3).

3.4 Growth and yield of fenugreek

Eco-friendly treatment on growing and yield of fenugreek seed is observed significantly higher in cow urine and dung slurry. The effect of treatment on plant height was recorded maximum in seed treatment with cow urine (73.33 cm), followed by seed treatment with panchagavya (72.87 cm), foliar spray of panchagavya (72.59) and foliar spray of cow dung slurry (72.42). Whereas, in primary branching, the highest effect was found in seed treatment with cow urine (5.22), foliar spray of cow urine (5.05), foliar spray of cow dung slurry and seed treatment with panchagavya (4.61). The secondary branches and number of branches are maximum in seed treatment with cow urine (5.94) and minimum in seed treatment with panchagavya (4.39). The number of pods/plants were found highest in seed treatment with cow urine (57.80), followed by seed treatment with vanaspativash (56.54), foliar spray of cow urine (56.08) and foliar spray of cow dung slurry (56.08). Fenugreek seeds no. of grains/pod are significantly increased in seed treatment with cow urine (18.04), followed by foliar spray of panchagavya (17.78), seed treatment with panchagavya (17.72) and foliar spray of cow urine (17.50). It was similar in foliar spray of cow dung slurry and foliar spray of panchagavya (17.78). The test weight of seed was found significantly higher in cow urine (14.06 g), followed by the seed treatment with cow dung slurry (13.94 g), foliar spray of cow dung slurry (13.83 g), foliar spray of cow urine (17.5 g) and seed treatment with panchagavya (13.43 g). The yield was found highest in seed treatment with vanaspativash (17.34 q/ha), followed by seed treatment with cow urine (17.30 q/ha), seed treatment with panchagavya (17.12 q/ha.) and foliar spray of cow dung slurry (16.85 q/ha). Among the treatments, the effect was not significant (Table 4).

Table 2: Effect of different media on mycelia growth of *C. traversiana* causing leaf spot disease of fenugreek

S. No.	Media	Mycelium growth diameter (mm)				Mycelium growth rate/h (mm)			
		48 h	96 h	144 h	192 h	48 h	96 h	144 h	192 h
1.	Potato dextrose agar	30.67	61.33	78	90	0.63	0.54	0.54	0.46
2.	Malt extract	25.67	48.83	76.5	87.5	0.53	0.53	0.53	0.45
3.	Nutrient agar media	6.50	9.5	14.5	16.5	0.13	0.10	0.10	0.08
4.	Cow urine based agar media	5.00	5.00	5.00	5.50	0.10	0.03	0.03	0.02
5.	± SEM	1.68	1.083	1.084	1.48	0.052	0.131	0.126	0.02
6.	CD (p=0.05)	5.054	3.250	3.265	4.38	0.158	0.393	0.378	0.06

Table 3: Efficacy of eco-friendly treatments on per cent disease intensity of *Cercospora* leaf spot disease of fenugreek

Treatments	Days of first disease appearance	Per cent disease intensity			
		9th Standard week	10th Standard week	11th Standard week	12th Standard week
T_1	76.00	13.43 (21.47)	18.35 (25.33)	24.64 (29.73)	33.31 (35.24)
T_2	73.67	14.27 (22.14)	18.33 (25.32)	24.83 (29.87)	33.47 (35.30)
T_3	73.67	13.46 (21.48)	18.69 (25.55)	26.45 (30.32)	35.24 (36.51)
T_4	76.00	15.66 (23.26)	18.61 (25.56)	26.74 (31.11)	35.15 (36.33)
T_5	71.33	14.15 (22.06)	18.81 (25.70)	26.59 (30.98)	39.33 (38.82)
T_6	71.33	15.00 (22.79)	18.62 (25.57)	25.26 (30.13)	39.76 (39.06)
T_7	71.33	13.96 (21.89)	19.23 (25.99)	27.93 (31.83)	38.97 (38.59)
T_8	71.33	15.25 (22.95)	18.07 (25.10)	27.95 (31.84)	40.31 (39.41)
T_9	70.67	15.51 (23.19)	20.06 (26.56)	27.81 (31.80)	40.29 (39.35)
T_{10}	71.33	17.36 (24.58)	19.75 (26.35)	26.95 (31.24)	40.21 (39.25)
T_{11}	68.75	17.88 (24.95)	20.25 (26.71)	28.72 (32.39)	41.34 (39.99)
± SEM	1.91	1.21	1.39	1.68	1.95
CD (p =0.05)	5.64	3.56	4.09	4.96	5.74
CV %	4.6	13.9	12.7	10.9	8.9

The parenthesis represent in ( ) Arc sine transformed value

Table 4: Efficacy of eco-friendly treatments on per cent disease control of *Cercospora* leaf spot disease of fenugreek

Treatments	Per cent disease control			
	9th Standard week	10th Standard week	11th Standard week	12th Standard week
T_1	24.22 (29.47)	22.87 (28.52)	20.99 (27.20)	19.33 (26.05)
T_2	20.08 (26.56)	21.73 (27.76)	20.72 (27.13)	21.41 (27.06)
T_3	24.49 (29.60)	17.87 (24.95)	14.65 (22.46)	17.85 (24.95)
T_4	22.22 (28.11)	19.16 (25.92)	14.76 (22.55)	17.77 (24.88)
T_5	20.93 (27.20)	27.01 (31.31)	14.39 (22.24)	16.00 (23.58)
T_6	22.02 (27.97)	20.05 (26.56)	15.52 (23.19)	19.29 (25.99)
T_7	20.25 (26.71)	19.50 (26.28)	16.21 (24.04)	17.20 (24.50)
T_8	18.52 (25.48)	18.45 (25.40)	14.90 (22.71)	18.95 (25.77)
T_9	19.94 (26.49)	21.66 (27.69)	14.82 (22.63)	15.60 (23.26)
T_{10}	16.15 (23.66)	16.89 (24.20)	14.55 (23.19)	18.34 (25.33)
T_{11}	00.00	00.00	00.00	00.00
± SEM	2.23	5.22	1.10	1.72
CD (*p* =0.05)	**5.51**	**5.40**	**3.27**	5.10
CV %	15.5	16.2	11.8	15.30

The parenthesis represent in ( ) Arc sine transformed value

Table 5: Efficacy of eco-friendly treatments on growth and yield of fenugreek

Treatments	Plant height (cm)	No. of primary branches	No. of secondary branches	No. of pods/ plants	No. of grains/pods	Test weight (g.)	Yield (q/ha.)
T1	73.33 (8.46)	5.22 (32.48)	5.94 (37.18)	57.80 (12.12)	18.04 (18.99)	14.06 (14.68)	17.30 (42.62)
T2	71.75 (6.12)	5.06 (28.42)	5.33 (23.09)	56.08 (8.78)	17.50 (15.43)	13.55 (13.70)	14.37 (18.46)
T3	71.31 (5.47)	4.67 (18.52)	5.55 (28.17)	53.99 (4.73)	17.17 (13.25)	13.94 (13.72)	14.36 (18.38)
T4	72.42 (7.11)	4.72 (19.79)	4.44 (2.54)	55.99 (8.61)	17.78 (17.28)	13.83 (12.80)	16.85 (38.91)
T5	72.87 (7.77)	4.61 (17.00)	4.39 (1.28)	55.17 (7.02)	17.72 (16.88)	13.43 (9.54)	17.12 (41.43)
T6	72.59 (7.36)	4.39 (11.42)	4.94 (14.08)	53.02 (2.85)	17.78 (17.28)	13.55 (10.52)	15.69 (29.34)
T7	71.52 (5.78)	4.05 (2.79)	5.56 (28.40)	56.54 (9.67)	15.93 (5.07)	12.93 (5.46)	17.34 (42.95)
T8	71.85 (6.27)	4.06 (3.04)	5.17 (18.93)	55.98 (8.59)	16.50 (8.83)	13.25 (8.15)	16.50 (36.02)
T9	70.93 (4.91)	4.11 (4.31)	4.78 (10.39)	52.33 (1.51)	17.00 (12.13)	13.90 (13.37)	13.80 (13.76)
T10	71.72 (6.07)	4.06 (3.04)	4.83 (11.54)	53.75 (4.26)	17.16 (13.19)	13.83 (12.80)	12.94 (6.67)
T11	67.61	3.94	4.33	51.55	15.16	12.26	12.13
± SEM	2.14	0.26	0.60	4.29	0.52	0.50	2.55
CD (*p*= 0.05%)	6.31	0.78	1.77	12.64	1.54	1.46	7.58
CV %	5.2	10.3	20.7	13.6	5.3	6.3	27.7

The parenthesis representing per cent increased values in ( )

4. Discussion

The disease symptoms occurred on fenugreek plants reported by (Bobev *et al*., 1999). The *Cercospora* leaf spot of fenugreek characteristics should be isolated by Kumar *et al.* (2021). Fenugreek leaf spot disease is caused by *C. traversiana*, has been reported by Elwakid and Ghoneem (2002), Sati (2015). This disease has been reported only anthracnose as reported by Young *et al*. (2004). This pathogen confirmed seed borne disease of *C. traversiana* reported by Leppik (1959), Zimmer (1984), Ryley (1989). *Cercospora* leaf spot disease of mungbean is isolated of pathogen conidia and conidiophores are similar as reported by Das *et al*. (2019). Plant extract and natural biocides of tobacco leaf extract with cow urine was found effective for both mycelia growth inhibition of *Sclerotia* formation is reported by Amin *et al*. (2013).

The inhibitory capacity of fresh cow products have reported many seed borne fungi, *viz., Cercospora, Alternaria, Bipolris, Fusarium* and *Colletotrichum* (Mishra *et al*., 2014; Mudigora *et al*., 2009). The cow urine obstructive activity against fungal pathogens have been reported by many scientists (Rajesh and Jayakumar, 2013; Basak *et al*., 2002; Rakesh *et al*., 2013). Panchagavya is an organic product and source of nutrients to play major role for plant growth promoting and provide immunity in plant system (Pagar *et al*., 2015; Sati, 2015). Review of this time is used mostly organic practices, improved crops yield in India and particularly dearth years (Singh *et al*., 2011; Ramesh *et al*., 2005). Panchagavya increased yield and production as reported by Lunagariya *et al*. (2019). Exploitation of panchagavya in fenugreek plants height is equal as reported by Naidu *et al*. (1999), Sridhar *et al*. (2001). Cow urine is the most useful for antifungal activities and control of many fungi. Fenugreek plant is tested of cow urine also used in the control of *C. travesiana* is reported by Jandaik *et al*. (2015).

5. Conclusion

The pathogen, *C. traversiana* was remote (isolated) fenugreek contaminated leaves and grow on potato dextrose agar (PDA) media. The confirmation of *C. traversiana* was done on the basis of microscopic studies on conidia and conidiophores from the pure culture of the pathogen. No growth was observed in cow urine based media. The effects of other treatments on disease appearance were found effective, but it was not significant in comparison to control. Organic treatments of seeds gave significant reduction in per cent disease intensity. Organic treatments were significantly decreased the per cent disease intensity in cow urine, cow dung slurry and vanaspativash. The decrease of per cent disease intensity was highest in cow urine and lowest in vanaspativash. The organic treatments used on fenugreek plant and observed significantly higher in cow urine and dung slurry. The effect of treatment on plant height was recorded maximum in seed treatment with cow urine. Organic treatments systematically increase the biological efficiency of fenugreek plants and disease resistance capacity also in plants. It is dire necessity to work extensively to examine the effect of cow products and botanically for controlling plant disease which are easily available with low cost for sound ecology and eco-friendly environment without any pollution.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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