ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 03, pp.1806-1809, March, 2019

DOI: https://doi.org/10.24941/ijcr.34246.03.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

EFFECT OF DIFFERENT FUNGICIDES AGAINST PHYTOPHTHORA INFESTANS (MONT) DE BARY CAUSING LATE BLIGHT OF POTATO

***,[1]Anurag Shukla, [2]Pathak, R. K. and [3]Divya Singh**

[1]Department of Plant Pathology C.S.A.U.A.T, Kanpur-2, India
[2]Department of Soil Science and Agricultural Chemistry C.S.A.U.A.T, Kanpur-2, India
[3]Department of Plant Pathology N.D.U.A.T, Faizabad, India

ARTICLE INFO

Article History:
Received 15th December, 2018
Received in revised form
27th January, 2019
Accepted 19th February, 2019
Published online 31st March, 2019

Key Words:

Food Poison Technique, Acrobat, Mancozeb, Pimaricin, Ampicillin, Rifampicin.

Corresponding author: **Anurag Shukla**

ABSTRACT

The aim of this experiment is Evaluation of various fungicides and their effectiveness at different doses against *Phytophthorainfestans*, the causal pathogen of late blight disease of potato. For the study of design Descriptive statistics was used and each treatment was replicated thrice by using complete randomize design. The experiment was conducted in Department of Plant Pathology, CSA University of Agriculture &Technology, Kanpur, Uttar Pradesh, India in November 2016. In this we use "Food Poison Technique" (1) to find out the relative efficacy of various fungicides in inhibiting the growth of pathogen. A small piece of infected leaf from border of sporulating lesion along with some healthy green tissue was cut and Sterilized. These small pieces were then placed on Pimaricin, Ampicillin and Rifampicin media (PAR media) which was previously poured in sterilized Petri plates. As soon as the mycelia growth is noticedaround the bits, the pathogen was purified by hyphal tip culture method. Mycelial bits of 5 mm from the pure culture were placed on the tomato extract media which was incorporated with various fungicides at different doses. In this we use five different fungicides among these Acrobat inhibited the mycelial growth upto 99.2% over the control at 300 ppm concentration followed by 98.44% inhibition at 300 ppm concentration mancozeb at 3500 ppm concentration inhibited the radial growth upto75.48% followed by 71.15% inhibition at 3000 ppm concentration. By this we concluded that this method can be used for analysing the efficacy of various fungicides against different pathogens within a very short period of time.

Citation: Anurag Shukla, Pathak, R. K. and Divya Singh, **2019.** "Effect of different fungicides against phytophthora infestans (mont) de bary causing late blight of potato", *International Journal of Current Research*, 11, (03), 1806-1809.

INTRODUCTION

Late blight of potato caused by *Phytophthorainfestans* (Mont.) de Bary is one of the most serious diseases of potato that caused Irish Famine in 1845. The pathogen is perpetuated through soil and seed tubers through production of resting spore i.e. Oospore. Several management practices like host resistance, cultural adjustments, biological management and use of fungicides have been adopted so far to minimize the disease. Cultural practice like field sanitation, summer ploughing, soil solarisation, soil amendments and crop rotation etc. can minimize the possibility of disease but cannot completely control the disease in standing crops. Another alternative method of disease management strategy is biological control. In this context, *Trichodermaharzianum, Trichodermaviride, Chaetomiumglobosum, Gliocladiumvirens* etc. have been exploited for management of diseases but biological control alone cannot manage the disease completely because a little fluctuation in temperature, pH, moisture etc. largely affects the efficacy of bio agent. The use of resistant variety is another important method which is reliable and cheap for management of plant disease but due to development of new races of pathogen, the resistant variety becomes susceptible one. Hence, the use of fungicides is the last and only method for management of plant disease (Li Biao Li Fei Zung GUO, 2011). Reported that the disease can efficiently be managed by spraying fungicide in early growth period (seedling stage to budding stage) and in late growth period (flowering stage to maturing stage) (Singh *et al*., 2003). Also reported that four sprays of Mancozeb at 8-10 days interval or two sprays of Mancozeb and one spray of Metalaxyl + Mancozeb were more accurate for controlling late blight (Shailbala, 2005). Screened fifteen fungicides against late blight and reported that new fungicides JE-874 at 10 ml/10 L, Curzate at 3 g/10 L and Melody at 5 g/10 showed 15.66%, 14.23% and 7.56% reduction in disease severity while Mancozeb at 0.2% and Ridomil MZ-72 at 0.2% sprayed plot showed 1.25% and 1.00% reduction disease severity.

MATERIALS AND METHODS

The present investigation was done at the Department of Vegetable Science and the lab work was done in Department of Plant pathology, Chandra Shekhar Azad University of

Agriculture and Technology Kanpur during October 2017. The procedure and techniques applied during the course of investigations were elucidated as below.

Isolation, Purification, Identification and Maintenance of *Phytophthorainfestans*

Collection of infected plant samples: Late blight infected leaves were collected from the potato field at Department of Vegetable Science, C. S. Azad University of Agriculture and Technology, Kanpur. Infected leaves with sporulating lesions were taken from the field and washed in sterilized water. The leaves were then placed in a humidity chamber with the leaf axial side up. They were incubated at 18±1°C in BOD (Biological Oxygen Demand), until sporulation appeared. Small pieces of infected tissue along with healthy portion from the sporulating border were cut and placed under potato slices in empty sterilized Petri-plates. The Petri-plates were incubated at 18± 1°C for 10 days until there was a growth of abundant mycelium on the upper side of the slice. Mycelium was taken from the tuber slices by using sterilized needle and transferred on the selective medium.

Isolations of pathogen: A small piece of infected leaf from border of sporulating lesion along with some healthy green tissue was cut and dipped in mercuric chloride solution (0.1%) for 30 seconds rinsed in sterilized distilled water thrice and dried off with sterilized. filter paper. The small pieces were then placed on PAR media i.e. (Pimaricin, Ampicillin and Rifampicin) which was previously pour in sterilized Petri plates. The plates were then incubated at 18± 1°C. The Petri plates were observed daily to find out the presence of mycelium around the leave bits. As soon as the mycelia growth is observed around the bits, the pathogen was purified by hyphal tip culture method.

Purification of Phytophthorainfestans: The white mycelial bits of *P. infestans* wasremoved from the margin of fungal colony and then transferred to another Petri plate which was previously poured with sterilized PAR medium. After purification, the pure culture of *P. infestans* was transferred on slant medium and incubated at 15-18°C in darkness till full growth. The culture was then transferred into the incubator at 10-12°C for further use.

Identifications of Phytophthorainfestans: The isolated pathogen was identified on the basis of its morphological and cultural characters and pathogenic behaviour towards the host. *P.infestans* belong to the class Oomycetes. The vegetative mycelium is characterized by the absence of cross walls, along with both asexual and sexual spores. The sporangiophores and sporangia emerge at asexual reproduction phase. The sporangia are pear shape, measurement of 21- 38 µm× 12-23 µm. Sporangia develop at the end of these sporangiophores. Oospores are found at sexual reproduction. When mycelia of different mating types of the fungus grow together, one of them may form antheridia and the other oogonia. The oogonium grows through the antheridium, allowing fertilization. The fertilized oogonium develops into a thick – walled oospore, while the oospore is orange red, nearly round – shaped, with measurement of 28-32 µm. The pathogen was found to produce the characteristics leaf spot symptoms on the affected plants.

In vitro activity of fungicides against Phytophthorainfestans: Five fungicides belonging to different groups were screened against the pathogen under laboratory conditions to find out their relative efficacy in inhibiting the growth of the pathogen in culture by the "Food Poison Technique" (Schimtz, 1930). Recommended quantity of each fungicide was incorporated in already prepared two per cent tomato extract medium prior to solidification and thoroughly mixed them by shaking prior to pouring in sterilized Petri plates. The medium was allowed to solidify and then 5 mm. bits of fungal culture from seven days old culture were placed at the center of Petri plates. The fungal disc was reversed so that the pathogen could come in direct contact with the medium. Three replications were kept for six treatments. The Petri plates were incubated at 18±1°C. One set of control was maintained in which the medium was not mixed with any fungicide but simply inoculated with the pathogen. The data on radial growth of fungal colony was measured in mm after every 24 hours. Radial growth of the mycelium was recorded. The per centinhibition over control was calculated by the following formula as given by Bliss (1934).

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

where

I = Per cent inhibition in mycelia growth
C = Growth of pathogen in control plates

RESULTS AND DISCUSSION

Effect of Mancozeb 75% wettable powder on radial growth of Phytophthorainfestans at 72 hrs. (in-vitro): Mancozeb is a broad spectrum non systemic fungicide with protective action. Mancozeb was evaluated in vitro against *P. infestans*by Poison Food Technique at 1500, 2000, 2500, 3000 and 3500 part per million concentrations after 72 hrs. of incubation. Data presented in Table 1. Showed that minimum radial growth of 22.05mm in diameter with 75.48% inhibition over control was recorded at 3500 ppm concentration followed by 3000 ppm (25.86mm, 71.15% inhibition), 2500 ppm (43.60mm, 51.76% inhibition), 2000 ppm (53.00mm, 39.25% inhibition), 1500 ppm with (55.35mm, 36.35% inhibition). From the table, it is clear that concentration of fungicide is inversely proportion with radial growth of mycelium. On the other hand, per cent inhibition of mycelium growth varied from 36.35 to 75.48 per cent. Mancozeb is moderately effective against *P. infestans*at recommended dose. From the table, it is also clear from Table 1 that there was significance differences at 0.05 level of significance among all the treatments.

Table 1. Effect of Mancozeb 75% WP on radial growth of *Phytophthorainfestans* at 72 hrs

Concentration(ppm)	Radial Growth(mm)	Inhibition (%)
1500	55.35	36.35
2000	53.00	39.25
2500	43.60	51.76
3000	25.86	71.15
3500	22.05	75.48
Control	90	
C.D	3.455	
S.Em	1.109	
S.Ed	1.568	
C.V	3.976	

Effect of Curzate 50% wettable powder on radial growth of Phytophthorainfestans at 72 hrs (in-vitro): Curzate is a non-systemic fungicide with protective in action. Curzate evaluated in against *P. infestans*by Poison Food Technique at 500, 1000,

1500, 2000, 2500, 3000, 3500 and 4000 ppm concentration after 72 hrs. of incubation. Data presented in Table 2, showed that minimum radial growth (23mm) with 72.80% inhibition was recorded at 4000 ppm concentration, followed by 3500 ppm (32.66mm, 62.10%), 3000 ppm (36.66mm, 57.64%), 2500 ppm (41.66mm, 52.10%), 2000 ppm (42.00mm, 51.78%), 1500 ppm (45.66mm, 47.65%), 1000 ppm (51.33mm, 41.35%) and 500 ppm (56.33mm, 35.80%). From the table, it is clear that concentration of fungicide is inversely proportion with radial growth of mycelium. On the other hand, per cent inhibition of mycelium growth varied from 35.80 to 72.80 per cent. Curzate is moderately compatible with *P. infestans*at recommended dose. Each treatment varied in variably and significant. From the table, it is also clear from Table 2. That there was significant difference at 0.05 level among all the treatments.

Table 2. Effect of Curzate 50% WP on radial growth of *Phytophthorainfestans* at 72 hrs

Concentration(ppm)	Radial growth(mm)	Inhibition (%)
500	56.33	35.80
1000	51.33	41.35
1500	45.66	47.65
2000	42.00	51.78
2500	41.66	52.10
3000	36.66	57.65
3500	32.66	62.10
4000	23.00	72.80
Control	90	
CD	2.988	
S.Em	0.959	
S.Em	1.356	
CV	3.642	

Effect of Bavistin 50% wettable powder on radial growth of *Phytophthorainfestans* at 72 hrs. (in vitro): Bavistin is a systemic fungicide with protective and curative in action. Bavistin was evaluated in vitro against *P. infestans*by Poison Food Technique at 10, 50, 100, 200, 300, 400 and 500 ppm concentration after 72 hrs. of incubation. Data presented in the Table 3 showed that minimum radial growth (3.30mm) with 92.88% inhibition was recorded at 100 ppm concentration followed by 50 ppm (6.35 mm, 88.57%), 10ppm (7.90 mm, 87.76%). However, no mycelial growth recorded at 200 ppm or above. Bavistin is not compatible at recommended dose. It is also clear from Table 3. That there was significance differences at 0.05 level of significance among all the treatments.

Table 3. Effect of bavistin 50% WP on radial growth of *Phytophthorainfestans* at 72 hrs

Concentration (ppm)	Radial Growth (mm)	Inhibition (%)
10	7.90	87.76
50	6.35	88.57
100	3.30	92.88
200	0.00	100
300	0.00	100
400	0.00	100
500	0.00	100
Control	70.00	
C.D	1.324	
S.Em	0.520	
S.Ed	0.736	
C.V	8.324	

Effect of Acrobat 50% Wettable Powder on Radial Growth of *Phytophthorainfestans* at 72 hrs. (invitro): Acrobat fungicide has excellent protect ant, systemic and anti-sporulant activity. Acrobat wasevaluated in vitro against *P. infestans* by Poison Food Technique at 50, 100, 200, 300 and 400ppm concentrations after 72 hrs. of incubation. Data presented in Table 4. Indicated that minimum radial growth of 0.50 mm in diameter was recorded at 300 ppm concentration which was followed by 200 ppm, 100 ppm and 50 ppm. However, no mycelial growth was recordedat 400 ppm. As per concern of per cent inhibition, the highest of 100% inhibition was recorded from400 ppm concentration of Acrobat (5) reported that Acrobat at 50 mg/ml supressed in vitrosporangium germination of *Phytopthorainfestans*. From the table, it is also clear from Table 4. that there was significance differences at0.05 level of significance among all the treatments.

Table 4. Effect of Acrobat 50% WP on Radial Growth of *Phytophthorainfestans* at 72 hrs. (in vitro)

Concentration (ppm)	Radial growth(mm)	Inhibition %
50	4.75	92.59
100	3.00	95.32
200	1.00	98.44
300	0.50	99.22
400	0.00	100
Control	64.12	
CD (0.05)	1.704	
SE(d)	0.774	
C.V.%	7.749	

Effect of Tebuconazole 50% Wettable Powder on Radial Growth of *Phytophthorainfestans* at 72 hrs. (in vitro): Tubaconazole is a systemic fungicide with protective and curative action. Tubaconazole was evaluated in vitro against *P. infestans* by Poison Food Technique at 200, 400, 600, 800and 1000 ppm concentrations after 72 hrs. of incubation.

Table 5. Effect of Tebuconazole 50% WP on Radial Growth of *Phytophthorainfestans* at 72 hrs. (in vitro)

Concentration (ppm)	Radial growth(mm)	Inhibition %
200	46.12	19.28
400	43.00	24.74
600	40.42	29.26
800	36.00	36.99
1000	33.22	41.86
Control	57.14	
CD (0.05)	2.811	
SE(d)	1.276	
C.V.%	3.665	

Data presented in Table 5. Indicated that minimum radial growth of 33.22 mm in diameter of mycelium growth with was recorded at 1000ppm concentration which is inhibited upto41.86% over control. The rest of the treatments like 800 ppm, 600 ppm, 400 ppm and 200 ppm also influenced the mycelium growth of fungi showing 36.00 mm, 40.42 mm, 43.00 mm and46.12 mm respectively. (6) reported that tricyclazole inhibited both mycelial growth and sporangia production at 0.1%. Tricyclozole is moderately effective against *P. infestans* at recommended dose. It is also cleared from the table that each treatment varied in variably and significantly at 0.05 level of significance.

Conclusion

The pathogen *Phytophthorainfestans* was isolated from potato leaves of Kufri Bahar variety showing typical late blight symptoms. The fungus growing on PAR media produced white colored mycelium, distinctive sympodialsporangiophores with pear shaped sporangia having distinct lemon shaped papilla. The description of the fungus agreed with the description given by Common wealth Mycological Institute, Kew, Surrey,

England, (7). Thus the pathogen causing late blight of potato has been identified as *P. infestans*. Successful pathogen city of the fungus on potato was proved following Koch's postulates by inoculating the spore suspension. Among the five different fungicides tested onmycelial growth of the *P. infestans*, the minimum radial growth of 0.50 mm in diameter was recorded at 300 ppm concentration of acrobat which was followed by 200 ppm, 100 ppm and 50ppm. However, no mycelial growth was recorded at 400 ppm. As per concern of per cent inhibition the highest of 100% inhibition was recorded from400 ppm concentration of Acrobat followed by Mancozeb of 22.05mm diameter with 75.48% inhibition at 3500 ppm concentration.

Acknowledgements

This research was supported by Department of Plant Pathology Chandra Shekhar Azad University of Agriculture & Technology, Kanpur.

Compliance with ethical standards: The authors declare that they have no conflict of interest. This article does not contain any studies with human participants or animals performed by any of the authors.

REFERENCES

Bruck, RI., Fry, WE. and Apple, AE. 1980. Effect of acrobat, an dimethomorph Fungicide, on developmental stages of *Phytopthora infestans*. *Phytopathology,* 70(7):597-601.

Ellis, MB. 1971. Dematiaceoushyphomycetes. C.M.I. kew, Surrey, English. 608.

Li Biao Li Fei Zung GUO, 2011. Control efficacy on fungicide against potato late blight. *Guizhou Agricultural Sciences*, 12: 133-135.

Mondal Bholanath, Pauria, NK. and Khatua, DC. 2015. Rapid laboratory evaluation of fungicides against *Phyto phthorainfestans* causing late blight of potato. *Journal of Scientific Research and Reports,* 2015; 4(2):168-1.

Schimtz, H. A. 1930. suggested toximetric method of food preservation. *Indus Engias Chem. Analyst.,* 4:89-104.

Shailbala, 2005. Studies on epidemiology and management of late light of potato caused by *Phytophthorainfestans* (Mont.) de Bary. Ph.D. Thesis G.B.P.U.A and T., Pantnagar.

Singh, PH., Singh, BP. and Singh, L. 2003. Need based application of fungicides for management of late blight in potato. *Journal Indian Potato Assoc.,* 30(1-2):143-144.

****