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RESEARCH ARTICLE

IMPACT OF DIFFERENT CULTURE MEDIA FOR THE GROWTH OF *RHIZOCTONIA SOLANI* CAUSING BLACK SCURF OF POTATO

Amanpreet Singh Sran[1], Jasvinder Kaur Sran[2], Amandeep Kaur[1], V.S. Pahil[1] and Bahaderjeet Singh[1]*

[1]College of Agriculture, Guru Kashi University, Talwandi Sabo, Bathinda, Punjab.
[2]Department of Environmental Science, Nalanda Open University, Patna, Bihar
Email: sidhubahaderjit@yahoo.in

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Abstract: Potato is an important food crop worldwide. The black scurf disease caused by *Rhizoctonia solani* has emerged as a major problem in potato cultivation in recent years for farmers among the Punjab region. The present investigation was carried out in the Department of Plant Pathology Laboratory, Guru Kashi University, Talwandi Sabo during 2022. Studying the growth pattern of a pathogen in different culture media is a crucial aspect of understanding its behavior and characteristics. In this context, seven culture media viz., Potato dextrose agar, Sabouraud's dextrose agar, Potato dextrose yeast agar, Oat meal agar, Czapek's agar, Mushroom compost agar and Water agar medium were used to compare the growth rate of *R. solani*. Out of seven culture media tested, maximum mycelial growth was recorded in potato dextrose agar per plate while minimum mycelial growth was recorded in Water agar. Significantly maximum number of sclerotia was observed in Potato dextrose agar while minimum number of sclerotia was produced by Czapek's agar medium. Moreover, no sclerotia was produced by *R. solani*on Water agar medium.

Key words: Potato, Culture media, Black scurf, *Rhizoctonia solani*

INTRODUCTION

Potato is a tuberous underground stem crop that belongs to the solanaceae family. Potato was recognized as a "Food for Future Prospect", to reflect its importance as a world food crop to address future global important food and nutrition security as well as poverty alleviation (FAO, 2008). Potato is the only crop that can replenish the country's food needs after cereals crops. Potato plays an important role in agriculture sector of India as it alone contributes about 21% of the total cultivated vegetable area and 28% of total vegetable production of India. The major potato producing Indian states are Uttar Pradesh, West Bengal, Bihar, Madhya Pradesh, Gujarat, Punjab, Assam, Haryana, Jharkhand, Chhattisgarh, Himachal Pradesh, Karnataka and Maharashtra.

The black scurf disease incited by *Rhizoctonia solani*Kuhn (Thanetophoruscucumeris) has emerged as a main problem in potato cultivation in recent years, affects the quality and quantity of potato and lowers its market value. *R.solani*is a phyto-pathogenic fungus in soil born nature with a wide host range as well as worldwide distribution. The maximum fungus colony diameter of *R. solani* (89.7 mm) was recorded on potato dextrose agar, which was comparable with PDA + rice leaf extract agar medium, according to Singh and Singh (2007). At 7th days after inoculation, potato dextrose agar showed the most growth, followed by corn meal agar, richards agar, malt extract agar, and water agar, while oat meal agar showing the least growth. Kumar *et al.*, (2014) found that PDA medium supported the maximum mycelial growth (60.1 mm) followed by Coon's (57.5 mm). On the other hand, minimum mycelium growth (7.2 mm) showed on the Czapek's Dox agar and oat meal medium. Meena and Chattopadhyay (2002) recorded that, Czapek's agar was shown to be most effective in mycelial growth of the *R. solani*. Potato dextrose agar (88.33 mm) produced the maximum mycelia growth of *R. solani* followed by Czapek's dox agar (77.26 mm) and Corn meal agar (74.46 mm) (Sharma *et al.*, 2013).

According to Tribikram Sahoo *et al.*, (2020), potato dextrose agar was the best medium for *R. solani*, while Sabouraud's dextrose agar was the most effective supportive media for *R. solani* growth. The bigger sclerotia formation found on Richard's Agar (4.95) followed by Yeast Peptone Potato Dextrose agar (4.25), Asthana & Hawkers agar (3.95), Yeast Extract Dextrose agar (3.65), while Malt extract agar (2.45) and Brown's agar (2.40) showing the smallest sclerotia formation (Kumar *et al.*, 2014). According

*Corresponding Author

to Prashant Kumar Singh *et al*. (2019) significantly maximum mycelial growth was observed on Potato dextrose agar (85.00 mm) followed by Potato stem agar medium (28.33 mm), Potato leaf agar medium (27.33 mm) and Corn meal agar (26.33 mm), Czapek's agar medium (26.00 mm), Malt extract agar (24.67 mm) and Water agar (20.67 mm) at 6 days after inoculation. A crucial and extensive knowledge of nutritional patterns and factors influencing the fungus growth is a prerequisite for any study leading to the understanding relationship between host and pathogen. Not much consideration has been given on the culture media parameters for the growth of *R. solani*. Therefore, extensive knowledge on the influence of various culture media for the growth of *R. solani* as well as characteristics of sclerotia of the fungus from black scurf infected potato tubers is needed to be developed for suitable management strategies of the disease and may help in physiological and taxonomical study of the fungus.

MATERIALS AND METHODS

Seven culture media viz., Potato dextrose agar, Sabouraud's dextrose agar, Potato dextrose yeast agar, Oat meal agar, Czapek's agar, Mushroom compost agar and Water agar medium were used to compare the growth rate of *R. solani* (Table-1). The experiment was laid in complete randomized design with three replications. Uniform quantity (20 ml) of each medium was poured in petri plates. Mycelial discs of 5 mm diameter from three days old cultures were transferred into the centre of each different sterilized culture media and incubated for 10^{th} days at 28±1°C. The plates were then sealed with parafilm and incubated at various incubation temperatures. Three replications were maintained for each medium. Observations were recorded as per methods used by Lal and Kandhari (2009). The diameter of the growth of the fungus was recorded by visual observation in mm with the help of a scale at 6^{th} day of the incubation after inoculation. The number of sclerotia was noted at 10^{th} day of the incubation after inoculation.

Table 1. List of culture media for isolation of *R. solani*

S.No.	Nameof Media	Ingredients	Quantity
1.	**Potatodextroseagar**	Peeledandslicedpotato	200.0g
		Dextrose	20.0g
		Agar-agar	20.0g
		Distilledwater	1000ml
2.	**Potatodextrose yeast agar**	Peeledandslicedpotato	20.0g
		Dextrose	20.0g
		Yeast	5.0 g
		Agar-agar	20.0g
		Distilledwater	1000m
3.	**Sabouraud's dextrose agar**	Mycological peptone	10.0g
		Dextrose	40.0g
		Agar	15.0g
		Distilledwater	1000ml
4.	**Czapek'sagar**	Sucrose	20.0g
		Sodiumnitrate	2.0g
		Di-potassiumphosphate	1.0g
		Magnesiumsulphate	0.5g
		Ferroussulphate	0.01g
		Potassiumchloride	0.5g
		Agar-agar	15.0g
		Distilledwater	1000ml

5.	**Water Agar**	Agar-agar	20.0g
		DistilledWater	1000m
6.	**Malt extract agar**	MaltExtract	20.0g
		Peptone	10.0g
		Agar-agar	20.0g
		Distilledwater	1000ml
7.	**Mushroom spent compost Agar**	Mushroom spent compost	200.0g
		Dextrose	20.0g
		Agar-agar	20.0g
		Distilledwater	1000 ml

RESULTS AND DISCUSSION

The *R. solani* was initially identified by the presence of thread-like whitish hairy mycelial growth. Growth of *R. solani* was studied on seven media viz., Potato dextrose agar, Sabouraud's dextrose agar, Potato dextrose yeast agar, Oat meal agar, Czapek's agar, Mushroom compost agar and Water agar medium. Colony growth and other characters of the pathogen measured at 6th days after inoculation and results are presented in Table- 2. Potato dextrose agar medium was significantly superior as compared with another media (Plate-1). Significantly maximum mycelial growth was observed in Potato dextrose agar (90.14 mm) followed by Sabouraud dextrose agar (86.77mm) Potato dextrose yeast agar medium (86.32 mm), Oat meal agar (70.48 mm) and Czapek's agar medium (67.94 mm), however minimum mycelial growth was observed in Mushroom compost agar (58.65 mm) followed by Water agar (37.05 mm), [Fig.-1]

The observations were recorded 6 days after inoculation, the data presented in table 7 showed that significantly maximum number of sclerotia was recorded in Potato dextrose agar (97.66 sclerotia/plate) followed by Sabouraud dextrose agar (92.33) Potato dextrose yeast agar medium (88.66) and Mushroom compost agar (48.00), however minimum number of sclerotia was produced in Oat meal agar (46.33) followed by Czapek's agar medium (31.00). No sclerotia was produced by *R. solani* in Water agar medium (Fig.-1).

In the present investigation, seven culture media viz Potato dextrose agar, Sabouraud's dextrose agar, Potato dextrose yeast agar, Oat meal agar, Czapek's agar, Mushroom compost agar and Water agar medium. Potato dextrose agar, Corn meal agar, Water agar, Czapek's agar medium, Malt extract agar, were evaluated to find out the effective media for the growth of R. solani. Significantly maximum mycelial growth was found and maximum number of sclerotia was observed in Potato dextrose agar. similar results were obtained by Lalan *et al*. (2013), Singh and Singh (2007), Khan *et al*. (2016), Gupta (2017), Sharma *et al*. (2013) and Kumar *et al*. (2014) who observed that the *R. solani*grew most rapidly on PDA, because PDA is supposed to be the most nutritive media for growth of *R. solani* as it uses carbon principally for its nutrition purpose. It has been further observed that PDA is a frequently used medium, due to its simple formulation and supportive nature of different plant pathogenic fungi. Several researchers have confirmed that PDA is most excellent for colony growth of different fungi (Meera *et al*., 2012; Saha *et al*., 2008). Zhou *et al*. (2002) studied the effects of 12 media on the mycelial growth, sclerotial number and mass of *R. solani* AG-1. The presence of potato starch in PDA might have stimulated the growth of *R. solani* because potato is the natural host of the pathogen.

Table 2. Mycelial growth and sclerotial number of *R. solani* on different culture medium

Medium	**Mycelial growth (mm) at 6th DAI***	**Number of sclerotia /plate**
Potato dextrose agar	90.14	97.66
Sabouraud's dextrose agar	86.77	92.33
Potato dextrose yeast agar	86.32	88.66
Oat meal agar	70.48	46.33
Czapek's agar	67.94	31.00
Mushroom compost agar	58.65	48.00
Water agar	37.05	0.00

SEm (±)	7.179	13.184
C.D. (P=0.05)	2.253	2.174
CV (%)	1.810	4.159

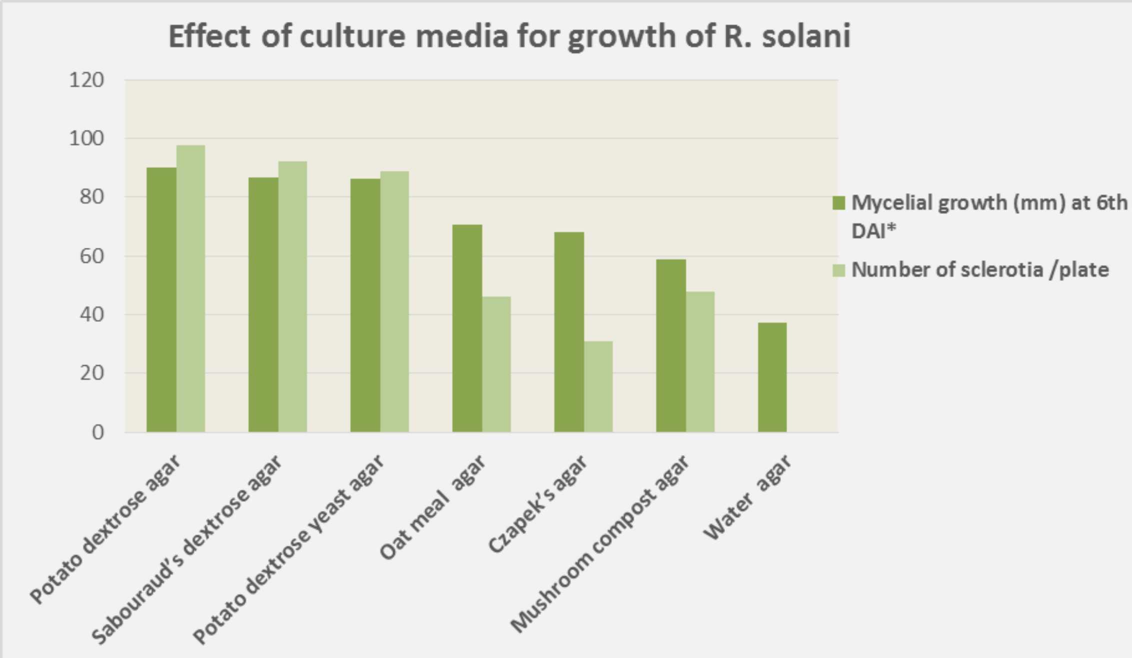

Figure 1. Mycelial growth and sclerotial number of *R. solani* on different culture medium

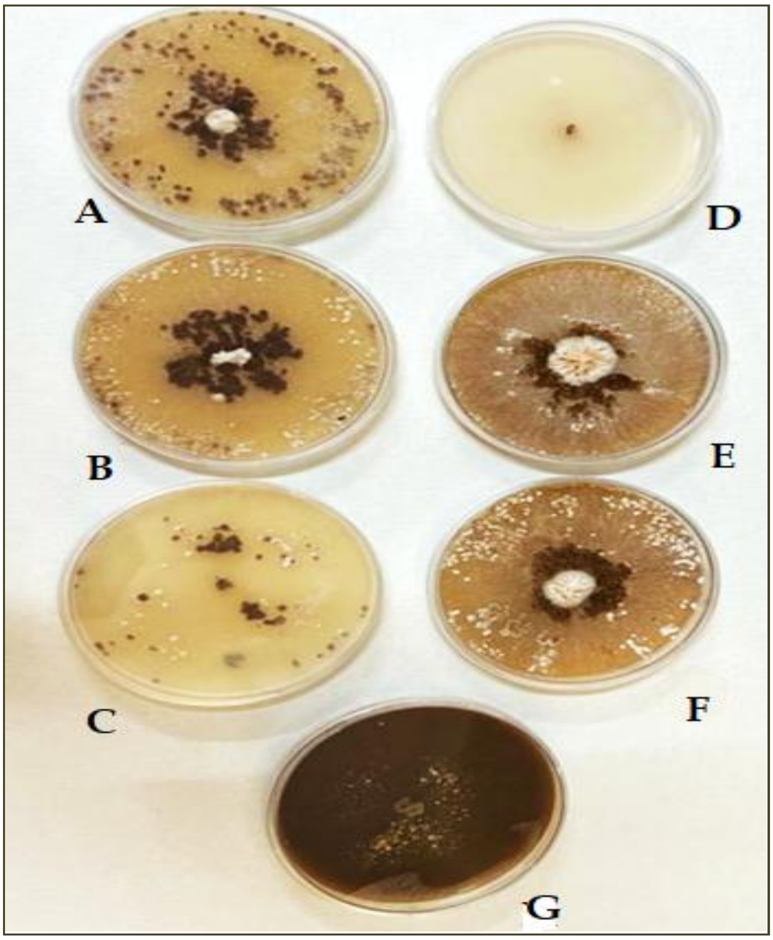

Plate 1. Mycelial growth and sclerotial number of *R. solani* on different culture medium

A). Potato dextrose agar
B). Sabouraud's dextrose agar
C). Czapek's agar
D). Water agar
E). Oat meal agar
F). Potato dextrose yeast agar
G). Mushroom compost agar

CONCLUSIONS

Based on the study, it was found that Potato dextrose agarsupported the maximum mycelial growth and maximum number of sclerotia production of R. *solani*. PDA provides a rich nutrient composition, including potato infusion and dextrose, which promotes the optimal growth and development of the fungus. On the other hand, Water agar medium showed minimum mycelial growth and no sclerotia production of *R. solani*. Water agar medium lacks essential nutrients, leading to poor fungal growth. It's worth noting that the choice of medium can significantly impact the growth characteristics of fungi.

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