

# Effect of Different pH Level on Mycelial Growth of Wilt Complex Fungi of Chickpea

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**Abstract** – Cultural studies of the three test fungi on different pH level revealed that, all the pathogens had a wide range of pH. The maximum radial growth of *Sclerotium rolfisii* was observed at pH 6.5 followed by pH 6.0 and 7.0 and whereas, for formation sclerotia was at pH 7.0. The *R. solani* preferred pH 6.5 for the radial growth and formation of sclerotia, which was at par with the pH 7.0 and 7.5. Optimum pH for the mycelial growth and formation of sclerotia by *S. rolfisii* was pH 5.5 to 7.5 and by *Rhizoctonia solani* was pH 5.5. to 8.0. The maximum growth and sporulation of *Fusarium oxysporum* f.sp. *ciceri* was observed at pH 6.5, while optimum pH level for growth and sporulation was ranged between pH 4.5 to 8.0.

**Keywords** – pH Level, Fungal Growth, Wilt, Chickpea, Sclerotia, Collar Rot, Root Rot.

## I. INTRODUCTION

Chickpea (*Cicer arietinum* L.) commonly known as Bengal gram or gram, is an ancient pulse crop, occupying an important place in the pulse cultivation and ranking 3rd amongst the global farming. In India, chickpea occupies an area of 4.9 mha, with production of 3.4 mt having an average productivity of 694 kg/ha (Anonymous, 2004). About 172 pathogens have been reported from 55 countries causing substantial damage in chickpea, out of which 89 pathogens have been reported from India alone. Amongst the serious diseases caused by different fungi are Ascochyta blight (*Ascochyta rabies*), wilt (*Fusarium oxysporum* f.sp. *ciceri*), black root rot (*Fusarium solani*) and wet root rot caused by *Rhizoctonia solani* (Nene and Reddy, 1987). Wilt complex, which manifests itself by vascular wilting or root rots, is one of the most devastating and challenging diseases, which can damage crop at any stage. The wilt pathogen can survive in soil in the absence of host for more than six years (Haware et al., 1986) and its invasion can destroy the crop completely causing significant yield loss (Haware and Nene, 1980). The disease, incited by a number of pathogens, is the devastating soil borne disease and difficult to manage. Scanty information is available on the disease which has agro-climatic conditions, congenial for the disease development, thus resulting in the heavy toll of the crop yield. Thus there is considerable potential of augmenting the yield of chickpea by minimizing the losses inflicted by the wilt complex. Keeping in view the importance of disease, variation among virulent isolates of these pathogens can be further classified for requirement of suitable hydrogen ion concentration for better mycelial growth and sclerotial/conidia formation.

## II. MATERIALS AND METHODS

Influence of different pH level on the growth of all the three wilt complex associated fungi (*Fusarium oxysporum* f.sp. *ciceri* (Padwick), *Sclerotium rolfisii* Sacc. and *Rhizoctonia solani* Kuhn) were studied. Nine different pH levels study from 4.0 to 8.0 with an 0.5 difference were adjust to the PDA medium. This was done before autoclaving with the help of HCL (0.1N) and NaOH (0.1N) by using the digital pH meter. The pH adjusted medium were poured into Petri plates and inoculated five mm disc of the test fungus were cut with the help of sterilized cork borer from the margin of seven days old culture grown on PDA Petri plate.

One disc was placed in the centre of each Petri plates. Three replications of each pH level were maintained for each of the pathogen and incubated at 28±2°C. The data on growth were recorded when the fungus reached the rim of the Petri plates (90mm) in any of the pH level. Variation in radial growth, type of fungal growth, pigmentation and/or sporulation were recorded. Number of sclerotia were also noted after 20 days of the incubation.

## II. RESULTS AND DISCUSSION

### *Influence of pH on Mycelial growth of the Associated Fungi*

Nine pH condition were subjected to the test fungi (*Fusarium oxysporum* f. sp. *ciceri* (Padwick), *Sclerotium rolfisii* Sacc. and *Rhizoctonia solani* Kuhn) to know the optimum pH for the growth and sporulation or sclerotial production of the test fungi.

Data presented in Table 1 revealed that *S. rolfisii* was able to grow, geminate sclerotia and produce sclerotia with wide range of pH level i.e. pH 4.0 to 8.0. The maximum radial growth of the fungus was observed at pH 6.5 (90.00 mm) followed by at pH 6.0 (87.00 mm) and 7.0 (78.67 mm). The optimum pH level for the growth and sclerotia formation by the fungus ranged from pH 5.5 to 7.5 (Plate 1a), where the fungus showed straight sparse mycelial texture and with increase or decrease of the pH level increase in compactness of mycelial texture was observed. The fungus produced light yellow pigmentation at all level of pH used. Maximum numbers of the sclerotia were found at pH 7.0. Intensity of sclerotia was slowly affected by increase or decrease of the pH level.

In case of *R. solani*, maximum mycelial growth and formation of sclerotia was observed at pH 6.5 (90.00 mm), which was at par with the pH 7.0 (89.00 mm) and 7.5. The optimum pH for the growth and sclerotial formation of the fungus ranged from pH 5.5 to 8.0 (Plate 1b). From the data (Table 1), it is clearly revealed that the fungus grow and

produce sclerotia towards alkaline condition (above pH 5.5), while with acidic condition (below pH 5.5), fungus showed poor growth with cottony compact mycelial texture and at pH 4.0 fungus can not grow or germinate sclerotia. The fungus produced light yellow pigmentation at all pH level.

Like *S. rolfisii*, *F. oxysporum*, f.sp. *ciceri* was able to grow, germinate and sporulate with the wide range of pH level i.e. pH 4.0 to 8.0 (Plate 1c). The maximum growth and sporulation was observed at pH 6.5, which was at par with the pH 7.0 and 8.0 (Table 1). The optimum pH level for growth and sporulation of the fungus ranged from pH 4.5 to 8.0. Only at pH 4.0 poor growth and sporulation was observed. At all pH level, fungus showed cottony compact mycelial texture with light purple to blue pigmentation on culture medium, except pH 4.0.

Misra and Haque (1962) reported pH 6.0 was optimum for growth and sclerotia formation of the potato isolates of *S. rolfisii* while pH 7.5 was optimum for chilli isolates (Kodandopany and Apparao, 1963). This indicated that optimum pH level for *S. rolfisii* might be different for different isolates. Dubey (1997) reported that, *R. solani* grew over a wide range of pH 3 to 10 and pH 6.5 supported maximum growth and excellent sclerotial production. Xu *et al.* (1997) stated the most suitable pH for *R. solani* was ranged between pH 5.4 to 7.3. Bai *et al.* (1988) stated optimum pH for the growth of *F. oxysporum* was 6.7 to 7.5 with a wider range of pH 4.3 to 9.8. Raghuvanshi (1995) showed the growth and sporulation of *F. oxysporum* f.sp. *sesami* was maximum between pH 6.5 to 7.5. Ehsan *et al.* (1998) also observed luxuriant growth of *F. oxysporum* at pH 7.0.

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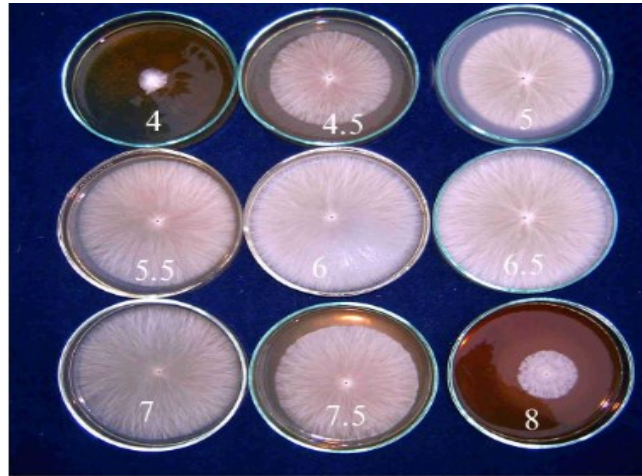
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Table 1. Variation in the growth of three soil borne fungi at different pH level.

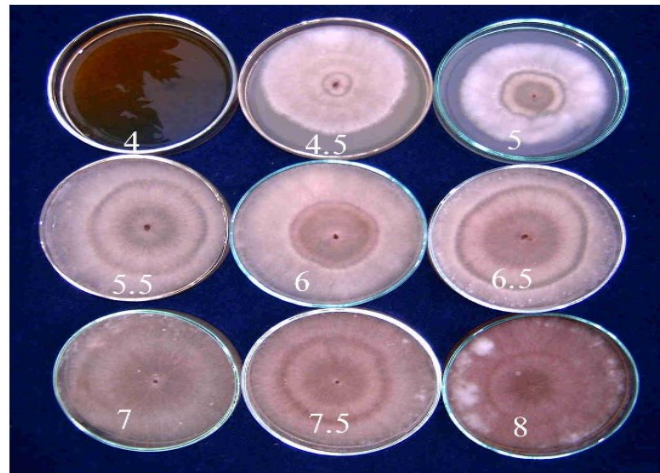
Fungi	Cultural character	4.0 pH	4.5 pH	5.0 pH	5.5 pH	6.0 pH	6.5 pH	7.0 pH	7.5 pH	8.0 pH	SEm ±	CD (5%)
<i>Sclerotium rolfisii</i> (5 DAI)	Colony diameter (mm)	16.33	45.67	56.00	68.00	87.00	90.00	78.67	67.33	25.00	1.37	4.07
	Type of colony	Dense compact	Sparse less compact	Sparse compact	Sparse less compact	Straight sparse	Sparse less compact	Straight sparse	Straight sparse	Dense compact		
	Pigmentation	Light yellow	Light yellow	Light yellow	Light yellow	Light yellow	Light yellow	Light yellow	Light yellow	Light yellow		
	Intensity of sclerotia** (20 DAI)	48.00 (1.689)	52.00 (1.720)	62.67 (1.803)	61.00 (1.791)	107.00 (2.032)	111.00 (2.048)	132.33 (2.123)	107.67 (2.035)	40.67 (1.612)	0.032	0.09
<i>Rhizoctonia solani</i> (5 DAI)	Colony diameter* (mm)	0.00 (0.707)	53.00 (7.314)	56.33 (7.539)	84.33 (9.210)	86.00 (9.300)	90.00 (9.513)	89.00 (9.460)	89.00 (9.460)	82.33 (9.101)	0.045	0.13
	Type of colony		Cottony compact	Cottony compact	Straight sparse	Straight sparse	Straight sparse	Straight sparse	Straight sparse	Straight sparse		
	Pigmentation	-	Light yellow	Light yellow with circle	Light yellow with circle	Light yellow with circle	Light yellow with circle	Light yellow	Light yellow with circle	Light yellow with circle		
	Intensity of sclerotia** (20 DAI)	0.00 (0.0)	03.67 (0.667)	06.00 (0.837)	12.33 (1.117)	14.33 (1.180)	16.67 (1.239)	14.33 (1.185)	14.00 (1.175)	05.33 (0.784)	0.050	0.15
<i>Fusarium oxysporum</i> f.sp. <i>ciceri</i> (8 DAI)	Colony diameter (mm)	32.34	69.34	72.00	78.67	74.34	85.34	82.00	68.67	82.00	1.267	3.76
	Type of colony	Cottony compact	Cottony less compact	Cottony less compact	Cottony less compact	Cottony less compact	Cottony less compact	Cottony less compact	Cottony less compact	Cottony less compact		

	Intensity of sclerotia (20 DAI)	Poor	Medium	Abundant	Abundant	Abundant	Abundant	Abundant	Medium	Abundant		
	Pigmentation	Light yellow	Light purple	Light purple	Light purple	Dark blue at center	Light purple	Light purple	Light purple	Dark blue at center		

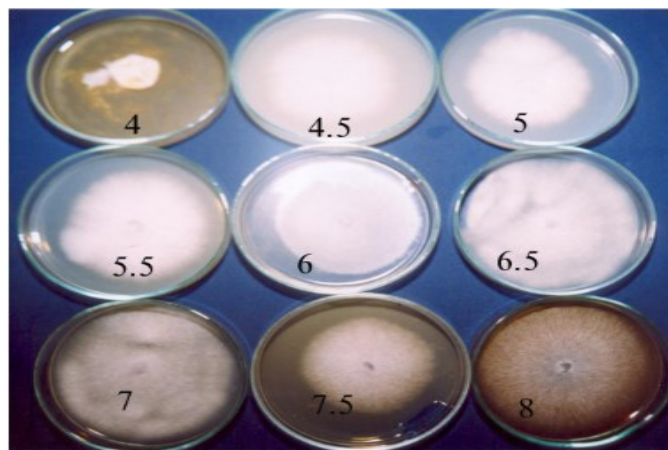
\* Figures in parenthesis are Square root transformed values; \*\* Figures in parenthesis are Log transformed values; Average of three replication; DAI-Days after Inoculation.



a. *Sclerotium rolfsii*



b. *Rhizoctonia solani*



c. *Fusarium oxysporum* f.sp. *ciceri*

Plate 1. Growth variation of wilt complex fungi at different pH level.