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In vitro evaluation of biosynthesized silver nanoparticles (Ag NPs) against soil borne plant pathogens

Pranjal Kr Kaman and Pranab Dutta*

Department of Plant Pathology, Assam Agricultural University, Jorhat, Assam, India
**Corresponding author*

Abstract

Efficacy of silver nanoparticle at different concentration (100 ppm, 50 ppm, 30 ppm, and 10 ppm) was tested against four soil borne plant pathogens *viz.*, *Rhizoctonia solani, Fusarium oxysporum, Sclerotinia sclerotiorum,* and *Sclerotium rolfsii* and. the result showed that the silver nanoparticles at 100 ppm significantly inhibit the mycelia growth of the pathogens.

1. INTRODUCTION

Soil borne pathogens may be defined as pathogens that causes plant diseases *via* inoculums that comes to the plant by way of the soil. These pathogens are difficult to control as they survive in the soil for many years with the help of a resting structures such as spores, conidia, sclerotia etc. Because of its long term survivality it can attack the plant through out the year causing drastic reduction in yield and productivity. Many strategies have been developed to combat against the soil borne pathogens but with no effect or little effect. So in order to overcome this soil borne pathogens a new technology has come known as nanotechnology in the discipline of plant pathology which can be exploited for plant disease management. Nanotechnology can be termed as the synthesis, characterization, exploration and application of nanosized (1-100nm) materials for the development of science. Nanoparticles are the buildings blocks of nanotechnology without which the science is incomplete. The increasing interest for safer and better process of biosynthesis has become a important aspects in isolating the nanoparticles which in turn eliminate the physical and chemical methods. Enviroment friendly method like biologically seems to be the safer in this context.

Therefore in this study an experiment was carried out to see the efficacy of silver nanoparticles synthesized from *Trichoderma asperellum* against important soil borne pathogens.

2. SOURCE OF SILVER NANOPARTICLES:

Biologically synthesized silver nanoparticles from *Trichoderma asperellum* was collected from nanotechnology lab, Department of Plant Pathology, Assam Agricultural University, Jorhat for *in vitro* evaluation against soil borne pathogens. The size of the silver nanoparticles was 27.64 nm, negative charge of value -1.34mV, Crytalline cubic in nature.

3. ANTIFUNGAL ACTIVITY OF SILVER NANOPARTICLES:

Silver nanoparticle inhibit the fungal growth of all the fungal pathogens viz., *R. solani, F. oxysporum, S. sclerotiorum,* and *S. rolfsii* at all concentration. With the increase in concentration of silver nanoparticle the radial growth inhibition (%) was increased and found maximum at 100 ppm concentration of silver nanoparticles (Fig. 1). Mycelial growth inhibition of 67.76, 68.14, 67.92 and 67.25 per cent for *Fusarium* sp.*, S. rolfsii, R. solani,* and *S. sclerotiorum,* was observed respectively In this study we have found that silver nanoparticles at a concentration of 100 ppm found significantly effective (Table 1) Antifungal activities observed in the study for silver nanoparticles might be due to disrupt ion transport systems including ion efflux (Morones *et al* ., 2005). Also, silver ions are detrimental to cells, causing damage to proteins, lipids, and nucleic acids (Storz *et al*,. 1999). There is a report that silver nanoparticles are highly reactive against pathogens as they generate Ag^{+} ions (Morones *et al* ., 2005)and also found that nanoparticles efficiently penetrate into microbial cells, which implies lower concentrations of nano-sized silvers would be sufficient for microbial control (Samuel *et al* ., 2004)

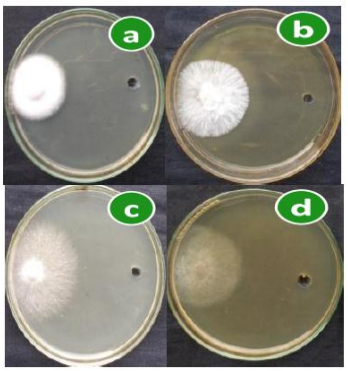

Fig. 1. *In vitro* efficacy of AgNP (100ppm) against a. *F. oxysporum*, b. *S. rolfsii,* c. *R. solani*, d. *S. sclerotiorum*

Table 1. Mycelial growth inhibition of biosynthesized silver nanoparticles

Treatments	**Mycelial growth inhibition (%)**			
	Fusarium oxysporum	***S. rolfsii***	***R. solani***	***S. sclerotiorum***
Ag NP 100 ppm	67.76 (54.76)[a]	68.14 (55.61)[a]	67.92 (55.49)[a]	67.25 (55.06)[a]
Ag NP 50 ppm	53.92 (47.24)[b]	58.51 (49.89)[b]	50.73 (45.40)[b]	54.07 (47.7)[b]
Ag NP 30 ppm	37.33 (37.64)[d]	36.29 (36.99)[d]	23.10 (28.73)[c]	38.95 (38.59)[d]
Ag NP 10 ppm	14.14 (22.30)[e]	6.67 (14.89)[e]	9.80 (18.24)[d]	13.92 (21.89)[e]
Carbendazim (3000 ppm)	50.25 (45.11)[c]	52.45 (46.38)[c]	46.45 (42.94)[b]	51.78 (45.97)[c]
S.Ed(±)	0.74	1.3	1.17	0.76
CD(0.05)	1.59	2.77	2.49	1.62

* Data in parenthesis are angular transformed value

* Data are mean of four replication

4. CONCLUSION

The present study showed that myconanoparticle synthesized from *T. asperellum* was found highly effective at a concentration of 100ppm for suppression of mycelia growth of the four soil borne pathogens. Our results support that silver nanoparticles will be useful in developing a new types of fungicidal material.

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