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EFFECT OF BIOSYNTHESIZED AGNPS ON PLANT GROWTH PROMOTION

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ABSTRACT

Myco-nanoparticles have several applications in the field of medicine and agriculture. During present study an endophytic fungi, *Didymella glomerata* was isolated from host plant *Maytenus emarginata* (Willd.) Ding Hou and used for biosynthesis of extracellular silver nanoparticles (AgNP). The nanoparticles were then used to assess their effect on growth of 7 plants. Seed dressing with biosynthesized AgNPs resulted into seed germination as well as root and shoot elongation in Chickpea (*Cicer ariantum*), Jowar (*Sorghum bicolor*), mungbean (*Vigna radiata* (mung), pigeon pea (*Cajans cajan*) , safflower (*Carthamus tinctorius*), soybean (*Glycine max*) and sunflower (*Helianthus annus*). However, the effect varied with the concentration of AgNPs used for seed treatment.

Key words: Endophyte, *Didymella glomerata*, AgNP, seed germination, Root and shoot.

Introduction:

Various physical and chemical methods for the synthesis of nanoparticles are being used, however, it is difficult to obtain them in pure form due to the contamination of precursor chemicals, use of toxic solvents and generation of hazardous by-products (Sunkar and Nachiyar, 2012). During present investigation attempts were made to prepare biologically synthesized silver nanoparticles using an endophytic fungi *Didymella glomerata* as an alternative to the chemical method.

Silver nanoparticles (Ag-NPs) improve seed germination, stimulates plant growth and increases the yield (Chandankere *et al.*, 2020; Priyom and Uma, 2017). With this consideration present investigation was undertaken on plant growth promoting activity of AgNPs prepared by employing an endophyte, *Didymella glomerata*

Materials and methods:

Plant parts stem and leaf of *Maytenus emarginata* (Willd.) were collected and endophytic fungi were isolated from them following Hallman *et al.* (2007) and Selvakumar *et al.* (2014). Identification of fungi was done using 18s rRNA ITS universal primers at Sai biosystems Pvt. Ltd. Nagpur. The pure culture of isolated fungal strain was maintained in Czapadox agar slants at 28°C.

The isolated fungi was grown on Czapadox broth supplemented with streptomycin, at 28 □C with constant shaking at the speed of 120 rpm for 72 hrs. Biomass of fungi was then harvested, filtered using Whatman filter paper and washed several times with sterile distilled water. The fungal biomass was transferred into 100 ml sterile distilled water and incubated for 48 hours. It was re-filtered and the cell-free filtrate was used for the preparation of silver nanoparticles.

SNP was prepared as described by Prabavathy *et al.*, (2015) and Kiran, (2017) For this purpose AgNO3 at the concentration of 1 mM, was mixed with with cell-free extract.The mixture was incubated at room temperature under dark conditions, and observed for color

development. Control was also simultaneously prepared, containing only cell free filtrate. The formation of silver nanoparticle was confirmed when the color was changed from pale white to reddish brown

In order to evaluate effect of biosynthesized silver nanoparticles on seed germination as well as root and shoot elongation, seeds of Chickpea (*Cicer ariantum*), Jowar (*Sorghum bicolor*), mungbean (*Vigna radiata* (mung), pigeon pea (*Cajans cajan*) , safflower (*Carthamus tinctorius*), soybean (*Glycine max*) and sunflower (*Helianthus annus*) were purchased from local market. Ten seeds of each crop plant were sterilized by dipping them in 5 % Sodium hypochlorite solution for 30 min. The sterilized seeds were then soaked in the solutions of biosynthesized AgNP, at different concentrations, overnight.

Five ml biosynthesized AgNPs solution of different concentrations were transferred separately into sterilized Petri-plates containing whatman filter paper and the seeds were kept on the filter paper. $AgNO_3$ and Distilled water were used as negative and positive control, respectively. Finally, all the Petri-plates of different seed samples were covered and incubated at room temperature for 5 days. Thereafter, the seed germination percentage was calculated, and shoot and root lengths were measured (Chandrakane, 2020; Priyom and Uma, 2017).

Results and Discussion:

Silver nanoparticles (SNP) using *Pestalotiopsis versicolor, Nemania* sp. and *Aspergillus sp* were also earlier prepared by Prabavathy et al., (2015), Kavish Rajput et al., (2017) and (Mohammad and Saeed. 2018) respectively.

During present study it was prepared with the help of *Didymella glomerata* . The biologically prepared SNP was evaluated for its growth promoting potential using pre-soaked seeds of Chickpea (*Cicer ariantum*), Jowar (*Sorghum bicolor*), mungbean (*Vigna radiata* (mung), pigeon pea (*Cajans cajan*) , safflower (*Carthamus tinctorius*), soybean (*Glycine max*) and sunflower (*Helianthus annus*).. Significant increase in seed germination, root and shoot elongation in AgNPs treated seeds was observed,

The seeds treated with biosynthesized AgNPs at the concentration of 50µl showed maximum germination (80 % in chickpea and pigeon pea, while 100 % in jowar), while it decreased in case of mungbean and sunflower. Almost similar results were obtained at other concentrations of AgNPs (Table 1)

At the treatment level of 50 µl AgNPs increased root length in chickpea, mungbean, pigeon pea, safflower, soybean, sunflower while, decreased in jowar, keeping the similar trend at increasing concentrations. Treatment with AgNPs increased shoot length in chickpea, mungbean, pigeon pea, soybean, sunflower while, decreased in jowar and safflower (Table 2). The results obtained are in agreement to those observed by earlier workers (Ashish *et al.*, 2016; Chandankere *et al.*, 2020; Asma et. al., 2019**).**

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Table. 1. Effect of biosynthesized silver nanoparticles on Seed germination

Sr. No	Seed	% Seed germination			
		50µl	100µl	200µl	Control
1	Chickpea	80	90	80	70
2	Jowar	100	90	90	90
3	Mungbean	70	80	80	80
4	Pigeon pea	80	80	80	70
5	Safflower	100	90	80	100
6	Soybean	70	80	80	70
7	Sunflower	90	100	100	100

Table.2 : Effect of biosynthesized silver nanoparticles on root and shoot lengths

Seed	Root and shoot length in cm							
	50µl		100µl		200µl		Control	
	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot
Chickpea	4.9	2.3	5.2	2.6	4.8	2	4.6	2.2
Jowar	6	2.2	5.8	2	5	1.8	6.3	2.4
Mungbean	3.2	4.9	3.8	5	4	5.2	2.6	4.6
Pigeon pea	4	2.4	4.6	2.8	4.6	2.9	3.8	2.3
Safflower	2.5	1.9	2.8	1.6	3.4	1.2	2.4	2.1
Soybean	1.6	1.2	1.8	1.6	2.2	1.9	1.3	0.8
Sunflower	2.6	1.8	3.1	2.2	3.4	2.6	2.4	1.6