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Studies on effect of Copper Oxide nanoparticles on Chickpea *Cicer arietinum* seed germination and root elongation

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ABSTRACT

Nanotechnology is an emerging branch of science. Nanoparticles have unique physical and chemical properties and thus used in diverse applications. In present study copper oxide nanoparticles were used to determine their effect on seed germination and root elongation. 5ppm and 10ppm concentrations of CuO NP prepared in distilled water. 20 seeds were treated with 5ppm and 10ppm concentration respectively for 30 min. 10 treated seeds were transferred aseptically per sterilized petriplates containing moist filter paper and labeled respectively. Similar experiment was carried out using distilled water as control. The experiment was carried out in duplicate. The plates were kept in dark for 7 days. 5ppm, 10ppm as well as distilled water treated seeds showed 100 % germination. The highest mean root length 16.93 cm was observed in 5ppm CuO NP treated seeds followed by 13.69 cm in 10ppm CuO NP treated seeds. While in control the root length was found to be 11.93cm. The current experiment reveled that these concentrations of CuO NP does not affect the germination but enhance the root elongation mechanism.

Keywords: Copper Oxide Nanoparticles, *Cicer arietinum* , Seed germination .

I. INTRODUCTION

Nanoparticles occur naturally as well as synthesized artificially having at least any one dimensions between 1-100 nm. Nanoparticles possess unique properties like high surface area to volume ratio, high reactive distinct properties [1-2]. Since nanoparticles have distinct properties are used in many industries for production of energy, transportation, pharmaceutical, antimicrobial, cosmetics and agriculture [3-5]. Nanoparticles of Gold(Au), Copper (Cu), Aluminum (Al), Silica(Si), Zinc(Zn), Zinc Oxide(ZnO), Titanium (Ti), Magnesium Oxide (MgO) have found applications in agriculture [6] . Nanoparticles are used in agriculture for enhancing crop production, protection, improvement in fertilizers and irrigation management. Copper is one of the essential micronutrient for the proper growth of plants. Copper deficiency in plant is expressed as curled leaves, petioles bend downwards and high chlorosis with permanent turgor loss in leaves, while the higher doses of Copper can cause toxicity, growth inhibition, photosynthesis interference, oxidative stress in plants [7-9]. The purpose of this study was to analyze the effect of CuO NP (synthesized using green technology) on germination and growth of *Cicer arietinum*. The *Cicer arietinum* is the Worlds' most consume pulses since it is rich in protein. It is believed that it was reached to Mediterranean region by 4000 BC and 2000 BC in India [10]. India produced 64% of the world total of chickpeas in 2016 [11].

II. METHODS AND MATERIAL

Seeds of Chickpeas (*Cicer arietinum*) were collected from a local farmer from Koravle village, Taluka Murbad, District Thane, Maharashtra India. CuO NP's were synthesized in laboratory of size the between range of 30-50 nm and used for the study. 5ppm and 10 ppm concentrations of Copper Oxide nanoparticles were prepared in sterilized distilled water. The seeds were transferred aseptically into these concentration solutions and rotated thoroughly and allowed to stand for 30 minutes. The seed germination and root elongation was studied using modified Top of paper method [12] The seeds were transferred aseptically in sterilized petriplates containing moist Whatman filter paper no. 1 and labelled respectively. The experiment was carried out in duplicate. Control was also maintained using seeds treated with distilled water. The plates were allowed to incubate at room temperature for 7 days. The seeds were observed daily. The results were recorded after 7 days.

III. RESULTS AND DISCUSSION

Results of the study were depicted in table no 1 and shown in fig no. 1. In current study findings showed 100% germination in 5ppm , 10 ppm CuO NP treated seeds as well as distilled water treated seeds also. The 100 percent seeds germination may be because of seeds were disease free and well preserved and stored which helps to maintain its germination quality. The highest mean root length 16 cm.93 was observed in 5ppm CuO NP treated seeds. In 10 ppm CuO NP treated seeds showed moderate root length i.e. 13.69 cm but found more mean root length than of distilled water treated seeds. This clearly indicate that CuO NP played an important role in seed growth. Khodakoyaskaya *et. al.* 2012 reported that nanoparticles have tendency to replicate plant seed coats and enhance seed germination and growth [13]. CuO NPs possess property to enhance water imbibition process. Ajey Singh *et. al.* 2017 reported reduced trend of plumule length, radicle length of *Vigna radiate* (L.) with increase in Nanoparticle concentrations [6]. The results of present study showed the same pattern but the root length of experimental seeds were found to be higher than root length of control seeds. This indicates that both CuO NPs concentrations were non-toxic to the seeds and root length promoting.

Table 1. Effect of CuO NP on *Cicer arietinum* seeds germination and root elongation

Test	DW	5ppm Cuo NPs	10ppm Cuo NPs
Mean seed germination	100%	100%	100%
Mean root elongation in cm	11.93	16.93	13.69

IV.CONCLUSION

The current experiment reveled that 5ppm and 10ppm concentrations of CuO NP prepared in distilled water did not show any adverse effect on seeds germination. When root elongation parameter was considered, 5 ppm CuO NP treated seeds found more effective than 10 ppm CuO NP treated seeds.

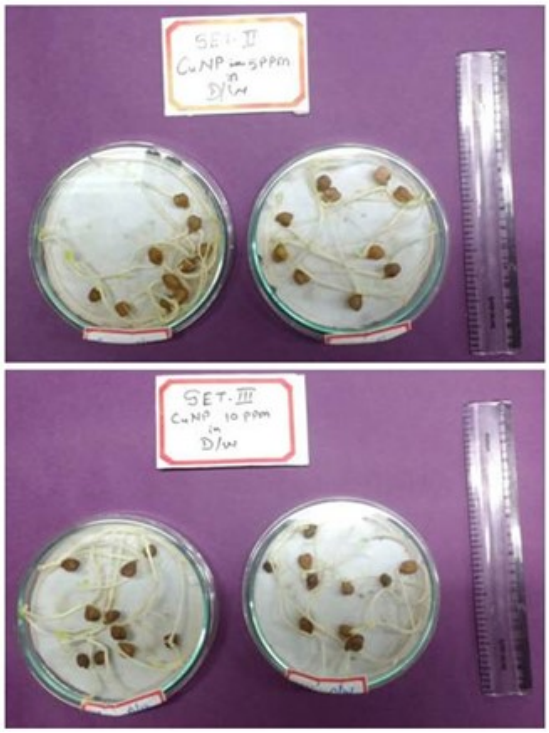

Figure 1. Effect of CuO NP on Cicer *arietinum* seeds germination and root elongation .

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