Journal of
Current Opinion in Crop Science
Journal homepage: www.jcocs.com; ISSN(O):2583-0392

SHORT COMMUNICATION

Evaluation of effective bacterial isolates for their plant growth promoting (PGP) activities in chickpea

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Article history:

Received: May 11, 2023
Accepted: June 21, 2023
Published: June 30, 2023

Citation: Kumar, S., Tiwari, R. K. S., & Nirmalkar, V. K. (2023). Evaluation of effective bacterial isolates for their plant growth promoting (PGP) activities in chickpea. *Journal of Current Opinion in Crop Science, 4*(2), 47-49.

ABSTRACT

Chickpea is mainly used for human consumption; a small proportion forms part of animal and poultry feed. Chickpea growing area contributes about 30 % of total pulse acreage and about 40 % of the total pulse production of the country. Inoculation with bacterial isolates revealed that germination percentage in all the treatments, including control, exhibited 100 per cent *in vitro*. After 96 hours of incubation, maximum root length (cm) was recorded in isolate BI 43 (3.43) followed by BI 31 (3.33), BI 78 (3.27), BI 68 (3.23), BI 36 (2.75), which were statistically at par with themselves.

Keywords: Chickpea, Plant growth promoting activity, Pulse, Root length, *Sclerotia rolfsii*.

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INTRODUCTION

Chickpea is considered one of modern agriculture's founder crops and an essential source of nutrients (Zohary and Hopf, 2000). Worldwide, the chickpea is the third most cultivated pulse crop after the *Phaseolus vulgaris* and *Pisum sativum*. It is a significant source of human food and animal feed because of its high content of lysine-rich protein, carotenoids and folates (Jukanti et al*.,* 2012; Jha et al., 2015; Ashokkumar et al., 2015). In addition, chickpea cultivation plays an essential role in farming systems as a substitute for fallow in cereal rotations, where it contributes to the sustainability of agriculture production and reduces the need for nitrogen fertilization by fixing free atmospheric nitrogen. Sharma et al*.* (2002) reported that seed treatment with *Bacillus* spp. This resulted in increased root and shoot length of rice seedlings, whereas foliar sprays with antagonists reduced sheath blight incidence in rice. Bais et al*.* (2004) reported that the antimicrobial compound surfactin produced by *B. subtilis* help in

both root colonization and plant protection against pathogen. Lee et al. (2008) reported that treatment with different isolates of *B. subtilis* significantly increased red pepper's root and shoot length. Kumar et al. (2011) reported that seed treatment with *B. subtilis* strain MBI 600 significantly increased shoot and root lengths at all concentrations in rice cultivars Cocodrie, Catahoula, and Trenasse under controlled conditions. Shoot and root length increased from 39 to 42 mm and 47 to 69mm, respectively, at a CFU concentration of 2.20 x 109 CFUs/ml in all cultivars compared to the control seedlings (20 mm). Furthermore, seed treatment with 2.20 x 108 and 2.20 x 109 CFUs/ml significantly increased seedling emergence by 81 to 89% more than control (61%) under greenhouse conditions. Similarly, seed inoculation with 2.20 x 109 CFUs/ml of MBI 600 resulted in increased shoot and root lengths and shoot and root weights.

MATERIALS AND METHODS

Effective isolates were evaluated in chickpeas for growth-promoting (PGP) activities in respect of different parameters, *i.e.*, germination per cent, root length, and shoot length. Initially, chickpea seeds were sorted to eliminate chaffy and broken seeds and immersed with 0.5% sodium hypochlorite for 5 min, washed with distilled water in three changes. Bacterial suspensions of different strains were used as seed priming. Before seed sowing, seeds were soaked in a bacterial suspension (one ml broth dissolved in 10 ml water) for 12 hours (seed priming) (Kumar et al., 2011). Uninoculated seeds served as control. Sixty seeds were uniformly placed in a plastic Petri plate in triplicate. *In vitro*, percentage germination was recorded in each Petri plate after 96 hours of seed plating. Plant growth parameters, *i.e.*, root length and shoot length (cm), were observed randomly for ten seeds after four days of plating from each treatment.

RESULTS AND DISCUSSION

The ten most effective isolates against *Sclerotia rolfsii* were tested for plant growth-promoting activities in chickpea regarding different growth parameters like germination percentage, root length, shoot length, fresh weight, and dry weight of root and shoots. Data presented in Table 1 & Figure 1 indicates that all the isolates had to have a growth-promoting effect in chickpeas. Germination percentage in all the treatments, including control, exhibited 100 percent *in vitro*. After 96 hours of incubation, maximum root length (cm) was recorded in isolate BI 43 (3.43) followed by BI 31 (3.33), BI 78 (3.27), BI 68 (3.23), BI 36 (2.75), which were statistically at par with themselves. Patel et al. (2017) reported that chili seedlings treated with *Bacillus* spp. have enhanced root and shoot length by 23.3-114.6% and 44.2-125.9% over uninoculated control under saline pot conditions. This report was similar to the present study results.

Table 1. *In vitro* evaluation of different isolates of *Bacillus* isolates on plant growth promoting activity in chickpea using seed inoculation

Treatment	After 96 hrs (Plate experiment)	
	Germination (%)	Root length (cm)
T1: BI 22	100	2.53
T2: BI 28	100	2.47
T3: BI 31	100	3.33
T4: BI 36	100	2.75
T5: BI 43	100	3.43
T6: BI 49	100	2.43
T7: BI 68	100	3.23
T8: BI 72	100	2.40
T9: BI 77	100	2.20
T10: BI 78	100	3.27
Control	100	2.13
C.D. 5%	-	0.63
CV	-	13.51

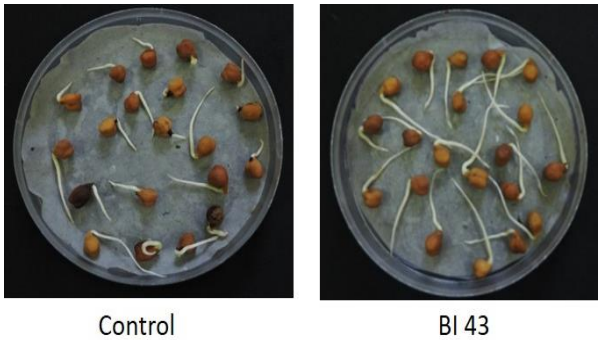

Figure 1. *In vitro* evaluation of different isolates of bacterial isolates on plant growth promoting activity in chickpea after 96 hours of bacterization.

CONCLUSION

Present study concluded that all the isolates have a growth-promoting effect in chickpeas. The 100 percent germination were exhibited in *in vitro*. After 96 hours of incubation, maximum root length (cm) was recorded in isolate BI 43, followed by BI 31, BI 78, BI 68, & BI 36, which were statistically at par with themselves.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by authors.

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