RESEARCH PAPER | Microbiology | Volume : 4 | Issue : 9 | September 2014 | ISSN - 2249-555X

Antagonistic Activity of Actinobacterial Isolates from Saline Soil against *Rhizoctonia bataticola* and their Growth Promoting Potential on Soybean.

KEYWORDS: Antagonistic Actinobacteria, PGPR, Rhizoctonia bataticola, saline soil

Amarja Shrikrushna Khendkar
Department of Microbiology, Shankarlal Khandelwal College, Godbole plot, Dabki road, Akola.

Aarti Rajeshwar Deshpande
Department of Microbiology, Shankarlal Khandelwal College, Godbole plot, Dabki road, Akola.

ABSTRACT *This study was undertaken to isolate actinobacteria from saline soil having potential of inhibiting soybean plant pathogen Rhizoctonia bataticola and promoting plant growth to increase crop production. Total 48 actinobacterial isolates were obtained by spread plate technique from 19 rhizospheric soil samples of different plants from the fields of saline belt of Akola District. Actinobacterial isolates were tested for antagonistic activity against Rhizoctonia bataticola by dual culture method. Total 11 out of 48 actinobacterial isolates exhibited antagonistic activity against Rhizoctonia bataticola. Plant growth promoting activity of these 11 isolates was tested on soybean seeds by evaluating the seedling vigor index (SVI) by paper towel method. Total 8 isolates demonstrated significant antagonistic activity and plant growth promoting potential out of which ASG35 and ASG27 of Streptomyces were more effective.*

Introduction

Soybean [Glycine max (L.) Merill)] is one of the major cultivable crops of Vidarbha region. Out of 443700 hectare cultivable land of Akola district, about 28.04% is of saline soil. Preference to soybean cultivation by farmers is continuously increasing from last few years in both saline as well as non saline soils. Damping off, root rot, stem rot, and charcoal rot due to Rhizoctonia bataticola are some of the common diseases of soybean causing drastic reduction in crop yields (Belkar et. al., 2013, Amer, 2005). Agricultural survey has reported 30 per cent yield loss in soybean due to Rhizoctonia root/stem rot in Vidharbha region of Maharashtra (Manglekar et. al., 1997). Developing biocontrol agents for controlling these diseases is necessary considering the hazardous effects of chemical fungicides. Biocontrol using Trichoderma sp. (Konde, et. al., 2008) and Pseudomonas sp. (Belkar, et. al., 2013) have been reported earlier. Application of actinomycetes for biocontrol of fungal phytopathogens has also been explored (Tokala et.al., 2002, Becker et.al,.1993, Yuan et.al., 1995). Antagonistic activity along with plant growth promoting activities of rhizospheric actinomycetes has been employed for protection and plant growth promotion of different crops. (Talwinder Kaur, et. al., 2013). Streptomyces Di 944 was reported earlier for antagonistic activity against Rhizoctonia solani (Siva, 1999)

Present study was undertaken to isolate native strains of actinobacteria from saline soil possessing significant antagonistic and plant growth promoting potential.

Methodology

Collection of soil samples

Total 19 soil samples were collected from rhizosphere of different plants including Soybean (S), Brinjal (B), ladyfinger (L), Mango (M), Turmeric (T), Ginger (G), Coconut (C), Onion (O), and Wheat (W) from saline tract of Akola district.

Isolation of Actinobacteria

Soil sample (1 g) was added in 9 ml sterile physiological saline and homogenized for 10 to 15 min. Serial dilution 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} were prepared and 0.1ml of each dilution was inoculated on synthetic actinomycetes isolation agar medium. Plates were incubated for 7 to 21 days in dark at 24^0c to 28^0c. Pure cultures were obtained by streaking individual colonies on actinomycetes isolation agar plates.

Test of antagonism

Antagonism test was done using dual culture method on synthetic actinomycetes agar medium against culture of Rhizoctonia bataticola obtained from Dept. of plant pathology, Dr. Panjabrao Krushi Vidyapeeth, Akola. Plates were incubated at 30°C for 7 days. Inhibition zones were measured.

Test of plant growth promoting potential

Selected actinobacterial isolates were inoculated on synthetic actinomycete broth and incubated in shaker incubator at 28^0c for 7 days. This fresh broth was applied on surface sterilized soybean seeds which were then arranged on the germination paper. This sheet was covered with another sheet of germination paper. Seeds without any application were taken as control. The papers were rolled carefully and the rolls were dipped in container containing water for 10 days (Paper towel method). Seedling vigor index was calculated after 10 days by using following formula

Seedling vigor index (SVI) = Mean of shoot length + Mean of root length x germination percent (Sunil, 1999).

Results and Discussion

Total 48 actinobacterial isolates were obtained from 19 rhizospheric soil samples of different plants. Total 11 actinobacterial isolates exhibited antagonistic activity against Rhizoctonia bataticola and 8 isolates showed increased SVI as compared to control. Results of zone of inhibition and plant growth promoting potential of selected actinobacteria are given in Table 1, Figure 1 and Table 2 respectively.

Table 1: Zone of inhibition against Rhizoctonia bataticola by dual culture method.

S.N.	Actinobacterial isolates	Zone of inhibition (mm) against Rhizoctonia bataticola
1	ASS11	3
2	ASS13	4

Volume : 4 | Issue : 9 | September 2014 | ISSN - 2249-555X

3	ASM17	2
4	ASM18	2
5	AST24	2
6	ASG27	4
7	ASG28	2
8	ASG35	5
9	ASW40	3
10	ASW42	2
11	ASC47	3

Table 2: Effect of actinobacterial inoculants on SVI of Soybean by paper towel method.

S.N.	Actino-bacterial Isolates	Germination %	Average shoot length	Average root length	Seedlings vigor index
1	ASS11	31	21.5	13.33	1079.73
2	ASS13	30	9.5	9.33	564.9
3	ASM17	19	17	11.25	536.75
4	ASM18	33	12.66	12.66	835.56
5	AST24	18	7	13.2	363.6
6	ASG27	100	11.87	11.62	2349
7	ASG28	44	9.1	17.5	1170
8	ASG35	90	15.25	13.25	2565
9	ASW40	49	8.9	8.1	833
10	ASW42	52	11.56	13.4	1297.92
11	ASC47	54	13.6	12.9	1431
12	Control	30	7.66	12.03	590.7

Fig. 1 Antagonistic activity of some isolates against Rhizoctonia bataticola

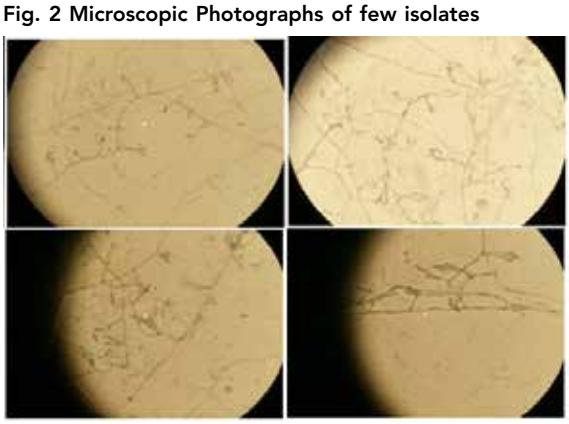
As evident from Table 1 best results regarding antagonism were obtained with ASG35, ASG27 and ASS13. Other isolates viz., ASS11, ASW40, ASC47, ASM17 ASM18, AST24, ASG28, ASW42 also demonstrated considerable antagonistic activity (Fig. 1).

As indicated in Table 2 best results of plant growth promotion were obtained with ASG35 followed by ASG27. Seeds treated with ASS13, ASM17 and AST24 showed less SVI as compared to Control while seed treatment with ASS11, ASM18, ASG27, ASG28, ASG35, ASW40, ASW42 and ASC47 resulted in significant rise in SVI over control.

Studies on plant growth promoting and antagonistic potential of actinomycetes have been reported earlier (Subramanium et. al.,2012, Jog et. al., 2012) where strains of Streptomyces CAI-21, CAI-26 and MMA-32, IDWR53 were employed for plant growth promotion and biocontrol. In the present study presence of good antagonistic potential against Rhizoctonia bataticola and plant growth promoting potential for soybean was noted in ASG35 and ASG27. These strains could be explored in future for their applied prospects.

Colonies of all the 11 isolates were characterized by colony characters and microscopic examination which revealed characteristic earthy odor and arial mycelia bearing spores in chains (Fig. 2). Colonies of some of the isolates were pigmented showing dark brown, red, yellow and gray colors. On the basis of preliminary examination 10 isolates including ASG35 and ASG27 appeared to be of Streptomycetes and one isolate ASM17 may belong to other genus.

Fig. 2 Microscopic Photographs of few isolates



Acknowledgments

Authors are grateful to Shankarlal Khadelwal College, Akola, for providing required facilities to carry out this work, Dr B.T. Raut, Ex Head of Plant Pathology Dept. Dr. Panjabrao Krushi Vidyapeetha, Akola and Dr. A.M. Deshmukh, Head of Dept. of Microbiology, Dr. B.A.M. University, Sub center Osmanabad for giving required information and support for this work.

REFERENCE

Amer M.A. (2005). Reaction of selected soybean cultivars to Rhizoctonia root rot and other damping-off disease agents. Commun Agric Appl Biol Sci.; 70(3):381-90. | Becker, J. O., and Schwin., F. J. (1993). Control of soil-borne pathogens with living bacteria and fungi: Status and outlook. Pesticide Sci. 37:355-363. | Belkar Y.K.& Gade R.M. (2013). Management of root rot and collar rot of soybean by antagonistic microorganism. J.Pl.Dis.Sci. Vol 8(1) : 39-42. | Jog R, Nareshkumar G, Rajkumar S (2012). Plant growth promoting potential and soil enzyme production of the most abundant Streptomyces spp. from wheat rhizosphere. J Appl Microbiol. 2012 Nov;1 13(5):1154-64. | Konde S.W. & Raut B.T. (2008). Management of Root/Collar Rot Disease in Soybean. Journal of Plant Disease Sciences 3:81-83. | Manglekar, R.K. and Raut, J.G. (1997). Survey of soybean diseases in Vidarbha and influence of few diseases on plantand yield parameter. PKV Res J. 21: 103-104. | Siva Sabaratnam, 1999. Biological control of rhizoctonia damping-off of tomato with a rhizospheric actinomncetes (Published doctoral thesis), Faculty of Graduate Studies University of Western Ontario London, Ontario. | Subramaniam Gopalakrishnan, Pagidi Humayun, Srinivas Vadlamudi, Rajendran Vijayabharathi, Ratna Kumari Bhimineni and Om Rupela (2012). Plant growth-promoting traits of Streptomyces with biocontrol potential isolated from herbal vermicompost. Biocontrol Science and Technology Volume 22, Issue 10. | Sunil Ingale, (1999). Role of Antagonist in control of Root Rot of Sunflower caused by Rhizoctonia bataticola (Taub) Buti.(Unpublished doctoral thesis), Dr.P.D.K.V, Akola. | Talwinder Kaur, Deepika Sharma, Amarjeet Kaur & Rajesh Kumari Manhas, (2013) Antagonistic and plant growth promoting activities of endophytic and soil actinomycetes. Archives Of Phytopathology And Plant Protection Vol 46 (14): 1756-1768. | Tokala, R.K., (2002). Novel plant- microbe rhizosphere interaction involving Streptomyces lydicus WYEC108 and the pea plant (Piusm sativum). Appl. Environ. Microbiol. 68:2161-2171. | Yuan, W.M. & Crawford, D.L. (1995). Characterization of Streptomyces lydicus WYEC 108 as a potential biocontrol agent against fungal root and seed rots. Applied and Environmental Microbiology 61, 3119–3128. |