ISSN: 0974-4908
http://www.rels.comxa.com

Res. Environ. Life Sci.
2(3) 179-180 (2009)
rel_sci@yahoo.com

Antagonistic reactions of rhizosphere microflora towards moth bean root rot pathogen

Deepali Chaturvedi*
Department of Botany, University of Lucknow, Lucknow-226 007, India
***e-mail:** dr.deepalichaturvedi@yahoo.co.in

(Received: February 18, 2009; Revised received: July 22, 2009; Accepted: August 03, 2009)

Abstract: Growth of a root through soil causes marked shift in the microbiological equilibrium, both quantitatively and qualitatively known as rhizosphere. Rhizosphere play an important role by affecting the associative or antagonistic microorganisms present in the rhizosphere of host resulting in reducing the soil borne diseases. Moth bean(*Vigna aconitifolia*), which is attacked by large number of pathogens resulting in varying degree of losses in terms of production ,is an important crop of arid zone.*Macrophomina phaseolina,*has been reported as the most devastating pathogen found invariably associated with bean seeds. So, these studies were carried out to throw light particularly in relation to soil microbes responsible for their associative and antagonistic effect on the pathogen in the vicinity of host plants roots. Different species of fungi, bacteria and actinomycetes were isolated from rhizosphere of moth bean crop, screened *invitro* in order to check their antagonistic properties against *M. phaseolina*.So that, soil borne diseases and their related pathogens can be managed by making changes in the dense and dynamic community of microbes in rhizosphere.

Key words: Rhizosphere, Moth bean, Root rot, Antagonistic effect*, M. phaseolina*

Introduction

Moth bean (*Vigna aconitifolia*) (Jacq.)Marechal is an important kharif pulse crop of India belonging to the family'Leguminosae'. It is a native of India. Moth is most drought resistant among the kharif pulses and is largely grown as a dry land crop, besides grown mixed with'jowar' and 'bajra'(Jain and Mehra, 1980).*Macrophomina phaseolina* Tassi.) Goid. *Rhizoctonia bataticola* (Taub.). Butl is an important root and foliar pathogen in many crops. *M. Phaseolina* causes seedling blight, root rot, collar rot diseases and found to be associated with moth bean seeds of Rajasthan (Singh and Srivastava, 1989). It is most universally distributed, saprophytic soil borne fungi with high competitive ability, high lethal potentiality and a wide host range that makes the fungus economically important (Dhingra and Sinclair,1975). It is mainly responsible for causing complex disease syndromes like root rot, seedling blight, charcoal rot, seed rot. Occurrence of dry root rot is very common in our own country (Route and Ingle, 1989). On moth bean, besides root rot *M. phaseolina* causes a progressive wilting,defoliation,loss of vigor and yields reduction(Shandhu and Singh,1999; Jain *et al.*,1982;Senecha and Srivastava,1982;Haware *et al.*,1986; Aggrawal *et al*., 2003) In the rhizoshphere microorganisms are known to synthesis a variety of metabolites. This possibility has been studied here with in relation to the moth bean root rot pathogen. In our study, fungal biocontrol agents like *Trichoderma harzanium, etc*. (Elad *et al*., 1982; Bhattacharya *et al.,* 1985) holds promise through manipulation of soil environment by the application of effective amendments (Short et al., 1980; Filho and Dhingra, 1980; Gamliel, 2000).

Materials and Methods

The microorganisms comprising 55 species of fungi, 4 bacteria and 2 actinomycetes isolated initially from infested soil, rhizosphere and rhizoplane of moth bean were screened for their antagonistic properties against *M. phaseolina* (Tassi.) *in vitro* screening was done employing Sabaroud's agar and 2 percent potato dextrose agar media. Simple inoculation technique for fungal interaction and agar streak method (Waksman, 1945) were used for bacteria and actinomycetes. Isolates showing inhibition in screening were picked up for confirmation of their reactions by Dual culture method. Czapeck's dox agar was used to test antagonistic reaction. Antagonistic activity was gauged by the width of inhibitory zone in mm.Dual inoculation test was carried out to confirm antagonism of bacteria against *M. phaseolina*.

Results

The antagonistic reaction of the test isolates against the pathogen varied from no reaction to highly antagonistic. Few fungi, bacteria and actinomycetes did not exhibit any antagonistic property while some fungi, bacteria and actinomycetes were found to be weakly antagonistic (Table 1). Four fungi *viz*. *Trichoderma harzanium, T.viridae, T.longibranchiatum, Aspergillus aculeatus.* Two bacteria *Bacillus subtilis* and *B.cereius.* One actinomycetes *Streptomyces griseus* gave distinct antagonistic reactions showing general stunting of the colony of test organism and development of a distinct zone of inhibition between the colonies of the antagonistic

Table - 1: Screening of microorganism antagonism against test pathogen (*in vitro*)

Microorganism	Test isolate	Antagonism in duel culture
Aspergillus flavus	Macrophomina phaseolina	++
Aspergillus fumigatus	Macrophomina phaseolina	—
Aspergillus aculeatus	Macrophomina phaseolina	+++
Fusarium udum	Macrophomina phaseolina	—
Penicillium notatum	Macrophomina phaseolina	—
Trichoderma harzanium	Macrophomina phaseolina	+++
Trichoderma viriens	Macrophomina phaseolina	++
Trichoderma longibranchiatum	Macrophomina phaseolina	+++
Trichoderma viridae	Macrophomina phaseolina	+++
Bacillus subtilis	Macrophomina phaseolina	+++
Bacillus cerius	Macrophomina phaseolina	+++
Streptomyces griseus	Macrophomina phaseolina	+++

++ Antagonist, — No reaction, +++ Good antagonistic reaction

ONLINE COPY

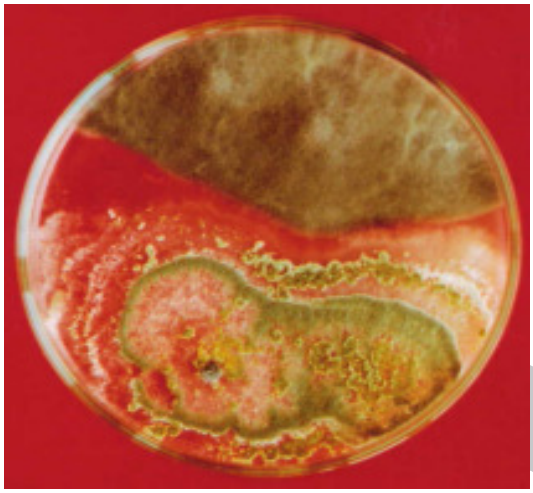

Fig. 1: *Trichoderma viridae* antagonistic to *M. phaseolina* (Tassi.) Goid

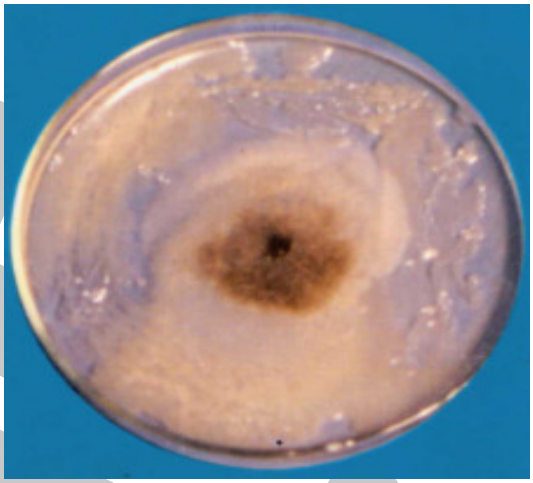

Fig. 2: Inhibition of growth of *M.phaseolina* by *Bacillus subtilis* using streak plate method

and the pathogen. They all show clear zone of inhibition when tested by dual culture method, showing stunting of *M. phaseolina* colony and a clear zone of inhibition between colonies of antagonist and the pathogen. Observations on the interaction of antagonistic bacterium and *M.phaseolina* on Czapeck's Dox agar indicated development of a clear inhibition zone after 5-6 days of inoculation (Burman and Lodha, 2000).

Discussion

These studies demonstrate the role of rhizosphere microflora in the causation, development and spread of root diseases of moth bean. In the rhizosphere, microorganisms are known to synthesize a variety of metabolites which proved to be antagonistic to root pathogens (Pridham *et al.*,1956; Alabouvette and Conteaudier, 1982; Baker and Cook, 1974; Bareja and Lodha, 2002). The antagonistic effect indicated by the suppressed growth of test organism may be due to the production of some antifungal substances in culture and parasitic nature of the antagonistic organism. Thus, we can say that biological treatment not only reduces the diseases but also increase plant stand and especially within the framework of integrated disease management system, that can be enormous benefit to the crop and eventually to farmers.

Acknowledgments

I am thankful to Dr. Satish Lodha, Senior Scientist, central Arid zone Research Institute, Jodhpur for their encouragement and support. I would like to express deep sense of gratitude to Prof. Vinay Sharma, Dean and Head, Department of Biotech and Bio-Science, Banasthali Vidhyapeeth for his valuable suggestions, guidance and constant support.

References

Aggarwal, R.K., Mathur, B.K. Sharma, S.K. and Lodha, S.: Integrating sub-lethal heating with *Brassica* amendments and summer irrigation for control of *Macrophomina phaseolina*. *Plant and Soil*, **256**: 423-430 (2003).

Akem, C. and Lodha,S.: Integrated management of soil-borne diseases of legumes in dry regions. *In:* Proceedings of International Conference on Integrated Plant Diseases Management for Sustainable Agriculture. *Ind. Phytopathol. Soc.*, **1:** 508-511 (2000).

Alabouvette, C. and Conteaudier, Y.: Biological control of *Fusarium* wilts with nonpathogenic *Fusaria*. *In*: Biological Control of Plant Diseases, Plenum Press, New York. pp. 415-426 (1992).

Baker, K.F. and Cook, R.J.: Biological control of Plant pathogens San Francisco: W.H. Freeman Press. p. 433 (1974).

Bareja, M., Israel, S. and Lodha, S.: Enhancing the population of *Trichoderma harzanium* utilizing on-farm wastes. *In:* Symposium on Asian Congress of Mycology and Plant Pathology, Mysore. p. 158 (2002).

Bhattacharya, D., Basu, S., Chattopadhyay, J. P. and Bose, S. K.:Biocontrol of *Macrophomina* root rot disease of jute by an antagonistic organism, *Aspergillus versicolor. Plant Soil*, **87**: 435-438 (1985).

Burman, U. and Lodha, S.: *Macrophomina* infection and expression in relation to plant water status of arid legumes. *J. Nat. Bot. Soc.*, **54**: 13-18 (2000).

Dhingra,O.D. and Sinclair,J.B.: Survival of *Macrophomina phaseolina* sclerotia in soil. *Phytopathology*, **65**: 236-240 (1975).

Elad,Y., Chet, I., Boyle, P. and Henis,Y.: Degradation of plant pathogenic fungi by *Trichoderma harzanium. Can. J. Microbiol.*, **77**: 190-195 (1982).

Filbo,E.S. and Dhingra,O.D.: Population changes of *Macrophomina phaseolina* in amended soils. *Transac. British Mycolog. Soc.*, **74**: 471-481 (1980).

Gamliel, A.: Soil amendments: A non-chemical approach to the management of soil borne pest. *Acta Horticulturae*, **532**: 39-47 (2000).

Jain, H. K. and Mehra, K. L.: Evolution and adoptions, relationships and uses of the species of *Vigna* cultivated in India. *In*: Advances in Legume Science, Kew Royal Botanic Garden. pp. 459-468 (1980).

Jain, S. C., Singh, R. C. and Mathur, J. R.: Seed mycoflora of moth bean. *Indian Phyopath.,* **27**: 151-152 (1982).

Lodha, S. and Burman, U.: Towards managing soil borne plant disease in arid region. Central Arid Zone Research Institute, Jodhpur, India. Technical Bulletin. p. 88 (2004).

Pridham, T.G. Linden Felser, L.A. Shotwell, D.L., Stodola, F.H., Benedict, R.G., Foley, C., Jackson, R.W., Zaumeyer. W.J., Preston, W.H. and Mitchell. J. W.: *Phytopathology,* **46**: 568-575 (1956).

Route, J.G. and Ingle, R.W.: Variations in isolates of *R.bataticola*. *Indian Phytopath.,* **42:** 506-508 (1989).

Sandhu, A. and Singh, R. D.: Factors in influencing susceptibility of bean to *M. phaseolina. J. Mycol. Plant Pathol.*, **29**: 421-424 (1999).

Senecha, P.L. and Srivastava H. P.: Leaf blight of *Vigna aconitifolia* caused by *M.phaseolina J .Indian Phytopath*, **35**: 160-161 (1982).

Short,G.E., Wyllie,T.D. and Bristow, P.R..: Survival of *Macrophomina phaseolina* in soil and in residue of soyabean. *Phytopathol.*, **70**:13-17 (1980).

Singh, S.K. and Srivastava, H.P.: Some new fungi diseases of moth bean. *Indian phytopath.*, **42**: 164-167 (1989).

Waksman, S.A.: Microbial antagonism and antibiotic substances. The common wealth fond. New York (1945).