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Microbial Biopesticides in Ecofriendly Management of Plant Disease

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SUMMARY

Chemical pesticides exert various serious effects on non-target beneficial organisms and consequently hazardous threat to the environment. Employing all the available alternate and non-toxic methods and techniques such as cultural, mechanical, biological, host plant resistance, are very essential for ecofriendly disease management. Amongst the different components of integrated disease management, more emphasis should be given on such non-chemical approaches, which are as well as socially acceptable and economically viable, which further need to be adopted and popularized. Microbial biopesticides, in this regards play a very important role in ecofriendly management of plant diseases.

INTRODUCTION

With the ever increasing population pressure throughout the world, there is very high demand for increased agricultural production and productivity. As the availability of agricultural land is limited, improved technologies like chemo intensive multistoried agriculture is being popularized for sustaining the population pressure in the world. Introduction of hazardous chemical fertilizer and pesticides although help us to get increased agricultural production, it also degrades environment in an alarming way as a result of its faulty practices. So now a day's concerned farmers, scientists and conservationists are thinking of sustainable farming systems in an eco-friendly manner. Before introduction of various agricultural chemicals, the crops had their own natural system of resistance to pathogens. The pathogens had natural enemies such as antagonists/ parasites etc. to keep their population below economic threshold level. But with time as the pest and pathogens are artificially controlled by the use of various chemical pesticides, they imbibed potential to build up resistance to a given chemical over a period of time. Similarly, the chemicals have been reported to cause serious mortality of beneficial insects such as pollinators, aquatic and wild life besides creating many residue problems causing hazards to human and animal health. So, an approach was needed to take up in an integrated way to reduce to use of harmful chemical pesticides and inorganic fertilizers and initiative must be taken to come out with biointensive package to manage pest and diseases and to meet nutritional requirement of crops, soil health in an eco-friendly way. Biopesticides, in this regards plays very important role as a part of integrated disease management in combating various plant diseases.

Biopesticides

There are three different classes of biopesticides, *viz*., microbial pesticides, plant-incorporated protectants (PIPs), and biochemical pesticides. Out of all these different classes of, microbial biopesticides constitute the largest group of biopesticides. Microbial biopesticides are the products obtained from beneficial microorganisms for management of various diseases and insect pests causing damage to agricultural crops. In case of microbial pesticides generally whole microorganism are used as pesticides as the active ingredient and have been used efficiently to manage various plant diseases. Microbial biopesticides are based on living organisms (bacteria, fungi, viruses and others). During the formulation process and storage, the viability of these organisms will have to be maintained at acceptable levels for the desired efficacy. Hundreds of various biopesticides are being developed from beneficial microorganism and many of them have shown promising effect on managing various plant diseases. In recent years, good numbers of improvised techniques have been developed specially for the mass production, storage, transport and application of the bioformulations. Microbial bioagent based bioformulations are commonly produced following three basic methods *viz.* solid fermentation, liquid fermentation and deep tank fermentation technology. Out of these solid and liquid fermentation is easy, popular and widely followed mass multiplication technology ideal for small scale production units.

Beneficial Microorganisms in Biopesticides Development

Various biological agents have been employed for management of the plant diseases. Among fungal antagonist, *Trichoderma* spp. has the ability to exert influence on most of the soil borne pathogens through competition, antibiosis, hyper-parasitism, lysis or other forms of antagonism (Elad *et al*., 1980). Ranjan *et al.*

(2002) reported that *Trichoderma* spp. could control rhizome rot and root rot caused by both fungal and bacterial pathogen *i.e.*, *Pythium, Fusarium* and *R. solanacearum.* Among antagonistic bacteria, *Pseudomonas fluorescens* under fluorescent *Pseudomonas* group is a major bacterial antagonist, which has the ability to suppress several seed, soil, air-borne fungal and bacterial pathogens (Burr *et al.,* 1978). Furuya and Matsuyama (1992) studied the role of antibiotics produced by *P. glumae* and its involvement in biocontrol activity and found that the antibiotics effectively inhibit the growth of *R. solanacearum in vitro* as well as *in vivo*. Similarly, Nath et al., (2016) developed a biointensive strategy using *Trichoderma parareesei, Pseudomonas fluorescens, Bacillus subtilis* and *Azotobacter chroococcum,* singly and in combination and recorded highest reduction of bacterial wilt incidence (95.09 %) of tomato was in treatment comprising of *T. parareesei + P. fluorescens + B. subtilis+ A. chroococcum*. Lazzaretti *et al.* (1995) reported that *B. subtilis* could produce antagonistic proteins highly inhibitory to seed borne fungal and bacterial pathogens. Bhattacharya (1996) used *B. subtilis* as seed, seedling and soil drenching treatment of cabbage seedling and found very effective in management of black rot of cabbage. The plant growth promoting rhizobacterial strain *B. polymyxa* significantly reduced bacterial leaf blight of rice caused by *X. oryzae* pv. *oryzae* (Islam and Bora, 1998). Further many *Streptomyces* spp. are found to be produce a wide range of antimicrobials compounds, elicit induced resistance and efficiently colonize the rhizosphere of different plant species (Kinkel *et al.,* 2012). Viruses as microbial pesticides have a history of slow development. A. Maestri and E. Cornalia made the first observations of viral infections in 1856. Hoffman reported NPV of nun moth in 1891 and Bolle demonstrated viral transmission from diseased to healthy insects in 1894.

Merits of using microbial biopesticides

- Microbial biopesticides are safe to the environment.
- Effect only the target pest and closely related organisms whereas conventional pesticides are broad spectrum pesticides.
- They are in general non-toxic, harmless to human being, animals and other natural fauna and flora.
- No residual problem.
- They not only manage plant diseases, but also enhance plant growth and soil health by way of encouraging the beneficial soil microflora.

Constraints of using microbial biopesticides

- Quality microbial biopesticides in getting them to the right place at right time in sufficient quantity to be effective is one of the major difficulties.
- High specificity, slow speed of action and their requirement of suitable condition for their survival.
- Exposure to bright sunlight or ultraviolet radiation and heat reduces the effectiveness of microbial biopesticides.
- Shelf life is very important in case of microbial biopesticides, special formulation and storage procedures are required for microbial pesticides.
- Apprehensions of growers about the efficacy of biopesticides.

Methods of application of microbial biopesticides

Some of the common methods of application of various biopesticides are as follows

Direct method: Soil application of biopesticides are done either before or at the time of planting to manage wide range of soil borne plant pathogens like *Ralstonia solanacearum*, *Fusarium* sp., *Rhizoctonia* sp. and *Sclerotium* sp. etc.

Seedling dip method: Ready to plant seedlings are placed in container containing bioagent spore suspension in water and the roots are immersed in the solution for about 30-60 minutes.

Seed coating method: Seed treatment is the most effective method of application of Biopesticides against soil as well as seed borne pathogens. Soak the seed in 1% solution, dry under shade and use for sowing.

Spray application: Foliar application of Biopesticides is done to restrict the air borne infection. In general, 0.5 to 1 % spray solution are being applied on the crop as a preventive or curative treatment against diseases.

CONCLUSION

The future of plant disease management cannot be in the shoulders of toxic chemicals and therefore, microbe based biopesticides has to play significant role in days to come. Availability of the quality microbial biopesticides in sufficient quantity, their popularization among the farming community is very important to grow biopesticide as an industry. Further, it is often found advantageous to combine beneficial biocontrol agents of different mode of action for better management of plant diseases. Therefore, there needs to be more scientific research and development work in this line to make the future of this approach more secure.

REFERENCES

Bhattacharya, A.K. (1996). Management of black rot of cabbage caused by *Xanthomonas campestris* pv. *campestris* (Pammel) Dowson. M.Sc. (Agri.) Thesis, Assam agric. Univ., Jorhat, Assam, India.

Burr, T.J.; Schroth, M.N. and Suslow, T. (1978). Increased potato yields by treatment of seed pieces with specific strains of *Pseudomonas fluorescens* and *P. putida*. *Phytopathol.* 68: 1377-1383.

Elad, Y.; Chet, I. and Katan, J. (1980). *Trichoderma harzianum*: a biocontrol agent effective against *Sclerotium rolfsii* and *Rhizoctonia solani. Phytopathol.* 70: 119-121.

Furuya, N. and Matsuyama, N. (1992). Biological control of the bacterial wilt (*Pseudomonas solanacearum*) of tomato (*Lycopersicon esculentum*) with antibiotic producing strains of *Pseudomonas glumae*. *J. Faculty Agric. Kyushu Univ.* (Japan) 37: 159-171.

Islam, N. and Bora, L. C. (1998). Biological management of bacterial leaf blight of rice (*Oryza sativa*) with plant growth promoting rhizobacteria. *Indian J. Agric. Sci.* 68: 798-800.

Kinkel, L.L., Schlatter, D.C., Bakker, M.G. and Arenz, B.E. (2012). Streptomyces competition and co-evolution in relation to plant disease suppression. *Research in Microbiology* 163(8):490–9.

Lazzaretti, E, Menten, J.O.M. and Bettiol, W. (1995). Treatment of wheat seeds with *Bacillus subtilis* for the control of *Pyricularia oryzae*, *Bipolaris sorokiniana* and *Alternaria tenuis*. *Phytopathologica* 21: 163-167.

Nath, B.C., Bora, L.C., Kataki, L., Talukdar, K., Sharma, P., Dutta, J. and Khan, P. (2016). Plant growth promoting microbes, their compatibility analysis and utility in biointensive management of bacterial wilt of tomato. *Int J Curr Microbiol App Sci* 5(6):1007–1016.

Ranjan, R.P.; Gupta, S.R.; Sarma, Y.R. and Jackson, G.V.H. (2002). Diseases of ginger and their control with *Trichoderma harzianum. Indian Phytopath.* 55(2): 173-177.