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A Depth study on Biological plant protection techniques

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Abstract

The paper analyses the key findings in biological plant protection strategies. It illustrates the extent of the usage of biological techniques in agriculture and explains the idea of advancement in the study of biological plant protection techniques. Low-volume microbiological preparation production and investigations of their integration at application get particular focus.

Keywords: Biological Control, Plant Protection, Technology.

Introduction

To preserve the quality and availability of food, feed, and fibre provided by producers across the globe, plant diseases must be managed. Plant diseases may be avoided, reduced, or controlled using a variety of strategies. Growers sometimes depend significantly on chemical pesticides and fertilisers in addition to sound agronomic and horticulture methods. Over the last 100 years, crop yield and quality have dramatically improved thanks in large part to such agricultural inputs. However, fear-mongering by certain pesticide opponents and the environmental damage brought on by improper and excessive use of agrochemicals have significantly altered people's views on the use of pesticides in agriculture. Today, the use of chemical pesticides is subject to stringent controls, and political pressure is mounting for the removal of the most dangerous chemicals from the market. Additionally, because of the potential scale at which such treatments would be required, the development of plant diseases in natural environments may make it impossible to successfully apply pesticides. As a result, several researchers in pest management have concentrated their efforts on creating synthetic chemical-free alternatives to control pests and illnesses. Biological control methods are a few of these choices. There are several biological controls that may be used, but their successful development will need a better understanding of the intricate relationships between plants, humans, and the environment. In order to combat plant diseases, this chapter provides a thorough overview of the theory and practise of biological management. This chapter will: I explain the different definitions and fundamental principles of biological control; (ii) investigate the connections between microbial diversity and biological control; (iii) outline the present state of biological control research and application; and (iv)

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conclude. Briefly describe potential future paths that might result in the creation of more varied and efficient biological plant disease controls. The FAO estimates that 12% of yearly agricultural output losses are attributable to only plant diseases. Changes in agricultural techniques will result in greater losses, and the tropical environment of our nation makes it perfect for the growth and spread of diseases that affect crops grown under sound management procedures. Controlling plant diseases is thus more crucial. Although numerous approaches are used for this goal, disease control using pesticides is the most promising, particularly under programmes for intense cropping. Their usage does, however, present some issues with residues left on crops, which have grown significantly in significance in recent years, not only in India but also throughout the globe. Additionally, the price of the chemical fungicides and bactericides used to control plant diseases is rising, and they also leave behind harmful compounds that are not biodegradable. When the dosage is surpassed, they turn into phytotoxic substances. Additionally, they harm the ecosystem. When utilised, chemical seed treatments only provide protection during the first phases of crop development. The use of chemicals to combat soil-borne illnesses is not cost-effective, is less efficient, and leaves residues on plants and the soil. Additionally, they are poisonous to soil's helpful bacteria. The plant infections may sometimes become resistant to fungicides and bactericides. Under the aforementioned conditions, it becomes necessary to produce microbial pesticides or bio-based, eco-friendly, and biodegradable insecticides to manage plant infections. An effective and affordable alternative to chemical pesticides for the treatment of plant infections is biological control or biocontrol employing hostile microorganisms. Ecological management of an organism community is what biological control is all about. It entails using microbes that fight illness to benefit plant health. The persistent expression of interactions among the plant (host), the pathogen, the biocontrol agent (antagonist), the microbial population on and around the plant, and the physical environment is disease suppression by the employment of biological agents. The following are some ways that biological control of plant diseases varies from biocontrol of insects (Table 1).

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Table 1: Disease vs. insect biocontrol

Sl. No.	Disease bio-control	Insect bio-control
1.	Disease control is largely achieved by antibiosis, competition and comparatively less by hyperparasites.	Largely by parasites and predators.
2.	Antagonists are largely passive and are not mobile.Contact of pathogen is accidental.	Parasites are active, mobile and seek their prey.
3.	It is a mass effect. For a single species of pathogen a large number of antagonists / competitors available.	Single predator / parasite for single prey.
4.	This method relies mainly on native organisms.	Introduction of parasites / predators from other countries are normally followed.
5.	Pathogen free seeds and planting materials are widely used.	Pest free seeds are not used.

How effective is biocontrol

The degree of disease control achieved by applying BCAs to a crop may be comparable to or even same to that attained by using fungicides. When a fungicide was applied to an apple that had been infected with Hytophthora cactorum, the disease was completely eradicated, but when different BCAs were applied separately, the degrees of disease suppression varied from 79% to 98%, depending on the BCA. Another research found that applying a Bacillus amyloliquefaciens BCA on mandarin fruit reduced the incidence of P. digitatum infection by 77%, compared to 96% after using the fungicide imazalil. If the fungicide does not negatively impact the BCA, adding a BCA with it may increase its effectiveness. Trichoderma atroviridae BCA treatment decreased Botrytis cinerea infection of strawberries to low levels; however BCA application combined with a

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fungicide completely eradicated the infection. It's interesting to note that in this instance, the fungicide alone performed worse than the BCA alone. In order to prevent potato powdery scab, Nakayama and Sayama (2013) observed an improvement in disease control employing a BCA fungicide mixture. The degree of disease suppression tends to be lower in the field trials when there are comparisons between glasshouse and field trials, for example, in the research by Fu et al. (2010), the degree of suppression was 24% lower in the field. This is said to indicate how diversified the field is now. Numerous studies have shown that bio-control may be used successfully against postharvest illnesses as well. Some entophytes provide defense against a variety of diseases. From the stems of Triticum aestivum L, an endophytic strain G3 with promise as a biocontrol agent was discovered. It was identified as a Serratia member by 16S rDNA sequencing. The ability of strain G3 to suppress disease has not been studied, despite the fact that it showed a wide range of antifungal activity in vitro against a variety of phytopathogens, including Botrytis cinerea, Cryphonectria parasitica, Rhizoctonia cerealis, and Valsa sordida. In experiments conducted in a greenhouse, the diseases Cytospora chrysosperma, Phomopsis macrospora, and Fusicoccum aesculi were all inhibited by a strain of Bacillus pumilis that was isolated from the endosphere of a poplar.

Host genotype effect

Lack of consistency in a BCA's disease suppression is one of the issues with biocontrol. Different reactions to a BCA are influenced by variations in host genotype. The degree of control varied across two cultivars of the host when Alcaligenes sp. treated Hevea brasiliensis for Phytophthora meadii infection. The development of plant compounds that activate transcriptional activators of the LuxR family in the bacteria may be connected to the specificity effect. The LuxR gene's byproducts function as global regulators, in charge of, among other things, biofilm formation and antibiotic synthesis. Although LuxR regulators typically function in quorum sensing systems, which allow bacteria to communicate with one another, some, like the PsoR gene of P. fluorescens and the OryR gene of Xanthomonas oryzae, respond to plant compounds, facilitating plant-BCA communication. Alternately, secondary metabolites produced by the BCA might act as a medium for communication. Endophytes create a wide variety of secondary metabolites, many of which

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have been inferred from genomic research rather than explicitly observed. There are instances when changes in the production of plant metabolites are induced by the synthesis of secondary metabolites, and vice versa.

Mixtures of BCA's

According to some researches, utilising BCA mixes has improved the consistency of biocontrol at locations with various environments. A combination of three bacterial BCAs was shown to be more effective at controlling disease in experiments on Phytophthora capsici infection of potatoes than utilising the individual strains. In their study of postharvest dry rot of potatoes, Slininger et al. (2001) discovered that formulations of mixed BCAs worked better consistently in 32 storage conditions with a range of cultivar, washing method, temperature, harvest year, and storage period. Slininger et al. (2007) demonstrated enhanced biocontrol for late blight in potato, diseases of poplar, chili, and cucumber using mixes of BCAs). Additionally, various combinations can be required for usage in regions with varying climates. As a result, it is necessary to discover several possible biocontrol agents. Combinations don't necessarily result in more control. Antagonism between the BCAs may sometimes lead to less control than with a single strain. Stockwell et al. (2011) discovered that combinations of Pseudomonas fluorescens A506, Pantoea vagus C9-1, and Pantoea agglomerans Eh252 were less efficient than the individual strains in controlling fire blight in pears. It was discovered that the Pantoea strains function by producing peptide antibiotics. These were destroyed in the combination by an extracellular protease produced by P. fluorescens A506. Antagonism amongst BCA strains has also been shown by Roberts et al. (2005). After co-incubation with Bacillus cepacia BC-1 or Serratia marcescens isolates N1-14 or N2-4 in cucumber rhizospheres, they saw that populations of Trichoderma virens GL3 or GL321 were both significantly reduced. These results emphasise how crucial it is to take potential strain rivalry into account when formulating a biocontrol strategy. Co-cultivation in vitro may sometimes, but not always, demonstrate inhibitory effects. Antagonism between the species in the combination would not have been apparent from co-cultivation of the three species in the research; it would only have been apparent if the mixture was examined in a confronting assay with the pathogen.

Conclusion

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Applying biocontrol chemicals correctly is crucial for their effectiveness. It works well as a seed treatment whether or not fungicides are used. This is employed mostly because of its wide range and variety of uses. In contrast to chemical fungicides administered at appropriate rates, it colonises roots, increases root mass, and enhances plant health, leading to production gains. Additionally, it may be conjugated with other microorganisms, which boosts its effectiveness. The two-fold benefit would be a decrease in pesticide usage, a reduction in illnesses that target the roots, and protection of transplants in the field due to its propensity to colonise roots. In addition, powdered formulations may be created and directly administered to the seed before the seeds are sowed. In addition to shielding the plants from disease assault, this would decrease the quantity of biocontrol chemical utilised. Additionally, plant growth would be enhanced.

References

1. Abraham A, Philip S, Jacob CK, Jayachandran K (2013) Novel bacterial endophytes from Hevea brasiliensis as biocontrol agent against Phytophthora leaf fall disease. BioControl 58:675–684
2. Alexander BJR, Stewart A (2001) Glasshouse screening for biological control agents of Phytophthora cactorum on apple (Malus domestica). N Z J Crop Hortic Sci 29:159–169
3. An Y, Kang S, Kim KD, Hwang BK, Jeun Y (2010) Enhanced defense responses of tomato plants against late blight pathogen Phytophthora infestans by pre-inoculation with rhizobacteria. Crop Prot 29:1406–1412
4. Arrebola E, Jacobs R, Korsten L (2010) Iturin a is the principal inhibitor in the biocontrol activity of Bacillus amyloliquefaciens PPCB004 against postharvest fungal pathogens. J Appl Microbiol 108:386–395
5. Barrangou R, van Pijkeren JP (2016) Exploiting CRISPR-Cas immune systems for genome editing in bacteria. Curr Opin Biotechnol 37:61–68
6. Bélanger RR, Labbé C, Lefebvre F, Teichmann B (2012) Mode of action of biocontrol agents: all that glitters is not gold. Can J Plant Pathol 34:469–479. doi:10.1080/07060661.2012.726649

ISSN: 2321-3914
Volume 2 Issue 3
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7. Benítez M-S, McSpadden Gardener BB (2009) Linking sequence to function in soil bacteria: sequence-directed isolation of novel bacteria contributing to soilborne plant disease suppression. Appl Environ Microbiol 75:915–924. doi:10.1128/aem.01296-08
8. Bisutti IL, Hirt K, Stephan D (2015) Influence of different growth conditions on the survival and the efficacy of freeze-dried Pseudomonas fluorescens strain Pf153. Biocontrol Sci Tech 25:1269–1284. doi:10.1080/09583157.2015.1044498
9. Bogino PC, Oliva MD, Sorroche FG, Giordano W (2013) The role of bacterial biofilms and surface components in plant-bacterial associations. Int J Mol Sci 14:15838–15859
10. Brader G, Compant S, Mitter B, Trognitz F, Sessitsch A (2014) Metabolic potential of endophytic bacteria. Curr Opin Biotechnol 27:30–37
11. Cai F, Yu G, Wang P, Wei Z, Fu L, Shen Q, Chen W (2013) Harzianolide, a novel plant growth regulator and systemic resistance elicitor from Trichoderma harzianum. Plant Physiol Biochem 73:106–113. doi:10.1016/j.plaphy.2013.08.011
12. Calderon CE, Perez-Garcia A, de Vicente A, Cazorla FM (2013) The dar genes of Pseudomonas chlororaphis PCL1606 are crucial for biocontrol activity via production of the antifungal compound 2-hexyl, 5-propyl resorcinol. Mol Plant-Microbe Interact 26:554–565 Card SD,
13. Walter M, Jaspers MV, Sztejnberg A, Stewart A (2009) Targeted selection of antagonistic microorganisms for control of Botrytis cinerea of strawberry in New Zealand. Australas Plant Pathol 38:183–192
14. Chernin L, Ismailov Z, Haran S, Chet I (1995) Chitinolytic Enterobacter agglomerans antagonistic to fungal plant pathogens. Appl Environ Microbiol 61:1720–1726
15. Choinska-Pulit A, Mitula P, Sliwka P, Laba W, Skaradzinska A (2015) Bacteriophage encapsulation: trends and potential applications. Trends Food Sci Technol 45:212–221. doi:10.1016/j. tifs.2015.07.001
16. Christen D, Tharin M, Perrin-Cherioux S, Abou-Mansour E, Tabacchi R, Defago G (2005) Transformation of Eutypa dieback and esca disease pathogen toxins by antagonistic fungal strains reveals a second detoxification pathway not present in Vitis vinifera. J Agric Food Chem 53:7043–7051. doi:10.1021/jf050863h

17. Clermont N, Lerat S, Beaulieu C (2011) Genome shuffling enhances biocontrol abilities of Streptomyces strains against two potato pathogens. J Appl Microbiol 111:671–682
18. Colburn GC, Graham JH (2007) Protection of citrus rootstocks against Phytophthora spp. with a hypovirulent isolate of Phytophthora nicotianae. Phytopathology 97:958–963
19. Conrath U, Beckers GJM, Flors V, Garcia-Agustin P, Jakab G, Mauch F, Newman MA, Pieterse CMJ, Poinssot B, Pozo MJ, Pugin A, Schaffrath U, Ton J, Wendehenne D, Zimmerli L, Mauch-Mani B, Prime APG (2006) Priming: getting ready for battle. Mol PlantMicrobe Interact 19:1062–1071
20. Coombs JT, Michelsen PP, Franco CMM (2004) Evaluation of endophytic actinobacteria as antagonists of Gaeumannomyces graminis var. tritici in wheat. Biol Control 29:359–366. doi:10.1016/j. biocontrol.2003.08.001

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