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Review Article

Role of Biological Control Agents in Integrated Pest Management Approaches

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Abstract

Insect play a significant role limits crop production. For their control, most of the farmers used chemical pesticides which have adverse impact on environment and human health. In India, insecticides are used a large amount than other pesticides such as fungicides and herbicides. Conventional insecticides acquire inherent toxicities that jeopardize to the environment and also effect on human beings and other living organisms. Negative effects of conventional insecticides on human health led to a resurgence in interest in botanical insecticides because of their minimal ecological side effects and save for exploit. To solve these problems there is need a modern concept of pest management based upon an understanding of agroecosystem ecology, and integration of various control tactics into pest management systems. IPM is a tactics pest management including monitoring of insect populations, cultural, mechanical, biological and chemical methods of insect-pest's management. In all several IPM tactics there is biological pests control are useful technique that discourage the development of populations of harmful organisms. The manipulation of beneficial organisms or natural enemies remains a very important tool in integrated pest management program of insect-pests all over the world. In the present studies have descried implement biological control tactics which act useful tactic in IPM. It also explains how biological control interacts with other IPM tactics. Biological control, i.e. natural enemies, has been accepted as an effective, environmentally non-degrading, technically appropriate, economically viable and socially acceptable method of pest management.

Keywords: IPM; Pesticides; Biological Control; Management

Introduction

Last 50 years farmers adopted broad-spectrum conventional insecticides such as organochlorines, organophosphates, carbamates and pyrethroids based pest control tactic. However, the chemical pesticide has adverse effects of on the environment, problems of resistance and resurgence reaching crisis proportions [1]. To reduce the use of synthetic pesticides in crop protection to need alternative and novel methods for pest control as IPM. Biological control has been a precious approach in pest management approaches around the world for long years. Biological control is the process to use of a living organism to reduce the population density of another organism (Jonsson., et al. 2008). There are main principles of biological control. Biological control tactics maneuver throughout the world as part of the management of pests in agriculture, forestry and horticultural crops. Although biological control has sometimes been commenced to combat arthropod pests that encompass developed resistance to insecticides. In the present status of increase population there is need to increase food production from the reducing agricultural land. To fulfil these objective farmers used chemical pesticides to reduce completions with insect-pests [2]. Due to over-reliance on chemical control, with the well-described consequences of pest resistance, uneconomic production costs, bioaccumulation through food chains, environmental pollution, loss of biodiversity and risks for human health. In the present review article, we also discuss about contribute of biological control to sustainable agriculture, increase biodiversity and limitations of biological control in integrated pest management.

Approach to Biological Control

Biological control agents have been utilizing in the management of insect-pests for long time in the different parts of the world. However, in last 3 - 4 decades have seen a dramatic increase in their use after the recognized some drawback of conventional pesticides against environment and human benign. After this incident farmers as well as police makers create an interest to understanding how they can better be manipulated as part of effective, safe, pest Management systems (Clark, 2007) are revealing surprising complexities in the life histories of these organisms. Although the long history of utilizing natural enemies, it wasn't until 1919 that the term biological control was it appears that used for the first time by the late Harry Smith of the University of California [3].

Tools of biological control

There are several living organisms are used to insect-pest's management as biological control agents. Biological control can also be defined as the utilization of natural enemies to reduce the damage caused by noxious organisms to tolerable levels. Biological control is often shortened to biocontrol.

Examples of biocontrol include the use of lady bugs to prey on aphids and scale insects and treatment of turf with spores of the bacterium *Bacillus popilliae*, which cause milky disease in Japanese beetle larvae.

Natural enemies of insect pests, also known as biological control agents, include predators, parasitoids, and pathogens. Biological control agents of plant diseases are most often referred to as antagonists. Biological control agents of weeds include seed predators, herbivores and plant pathogens.

Predator

A predator is an animal that depends on predation for its food. In other words, predators sustain life by killing and consuming animals of other species. The predatory behaviour is widespread among insects, spiders and mites. There are more than 40 families of insect predators that are significant for pest suppression in agriculture and forestry of these, the Anthocoridae, Pentatomidae, Reduviidae, Carabidae, Coccinellidae, Staphylinidae, Chrysopidae, Cecidomyiidae, Syrphidae, Formicidae, Gerridae, Miridae, Vellidae and Dytiscidae are most commonly found preying on pest species in crop fields. Virtually all members of all the 60 families of spiders (Araneda) are predators. Vertebrate predators that attack insect pests include birds, small mammals (bats), lizards, amphibians (frogs and toads), and fishes.

Parasite

A parasite is an organism living in or on another living organism, obtaining nutrients from their host, resulting altered growth, development and reproduction or death for the host. Approximately 10% of all insect species can be classified as parasitoids. The main difference between parasites and parasitoids is that parasites may not kill their hosts but parasitoids do. About 75% of the parasitoids are Hymenoptera; the remaining 25% is composed of Diptera, Strepsiptera, Neuroptera, Coleoptera and Lepidoptera.

Members of 43 families of the order Hymenoptera are parasitoids. Twelve families of Diptera contain some species whose larvae are parasitoids of arthropods and snails. 26 families of parasitoids have been used in biological control. The most frequently used groups in the Hymenoptera are Braconidae, Ichneumonidae, Eulophidae, Pteromalidae, Encrytidae and Aphelinidae. Some parasitoids are also found in the insect order Strepsiptera, Lepidoptera and Coleoptera, although parasitism is not typical of the Lepidoptera and Coleoptera.

Pathogens are diseases that attack pest insects. Pathogens of agricultural pests are usually bacterial, fungal or viral. A large range of micro-organisms such as bacteria, viruses, fungi and protozoans have since been identified as potential candidates for use in biocontrol strategies against insect pests [4].

Bacteria

Most of the pathogenic entobacteria are comes under the family's Bacillaceae, Pseudomonadaceae, Enterobacteriaceae, Streptococcaceae, and Micrococaceae [5]. There is much diverse kind of bacteria that are identified to acutely or chronically infect insects, but only members of two genera of the order have ever been registered to control insects i.e. Eubacteriales, *Bacillus* (Bacillaceae) and *Serratia* (Enterobacteriaceae). *Bacillus* is through far the most significant microbial pesticide genus. The species of the Bacillaceae, *Bacillus thuringiensis (B. t.)*, has been the most widely used and successful microbial pesticide. There are several important subspecies of *B.t.* that have been registered and marketed as separate products on different insect pests. These include *Bacillus thuringiensis* subsp. *aizawai (B.t.a)* for control of other Lepidoptera less susceptible to *B.t.k., Bacillus thuringiensis* subsp. *Israelensis* for control of mosquitoes and blackflies, and *Bacillus thuringiensis* subsp. *Tenebrionis* for control of leaf beetles in the family Chrysomelidae.

Virus

The first accounts of baculovirus infections come from diseased silkworms in ancient China [6].

It was also during this time that the large nuclear polyhedrosis viruses (NPVs) were distinguished from the much smaller granular looking viruses (i.e., granulosis viruses (GVs)). Bergold was the first to characterize the rod-shaped virions found within the occlusion bodies in the 1930s and 1940s.

It was also during this time that the utility of baculoviruses as biocontrol agents was described [6]. Viruses have been isolated from more than a thousand species of insects from at least 13 different insect orders [5].

Entomopathogenic viruses from almost a dozen viral families have been isolated: Ascoviridae, Baculoviridae, Birnaviridae, Iridoviridae, Nodaviridae, Parvoviridae, Picornaviridae, Poxviridae, Reoviridae, Rhabdoviridae, and Tetraviridae [7,8]. But the Baculoviruses i. e. family currently consists of two genera, the Nucleopolyhedroviruses (NPVs) and Granuloviruses (GVs). These new genera replace the Nuclear Polyhedrosis Viruses (Subgenus A) and Granulosis Viruses (Subgenus B), respectively.

Fungus

As with the bacteria, the diversity of fungi known to infect insects is great. Entomopathogenic fungi are found in the division Eumycota in the subdivisions: Mastigomycotina, Zygomycotina, Ascomycotina, and Deuteromycotina [9]. The two most important orders are the Entomophthorales (Zygomycotina: Zygomycetes) and the Moniliales (Deuteromycotina: Hyphomycetes syn. Deuteromycetes).

Recently there has been a move to reclassify the imperfect fungi (i.e., Deuteromycotina) as mitosporitic fungi because their sexual stages are unknown or no longer exist and they cannot be effectively classified.

Unlike the bacteria and viruses, which must be consumed, toxicity from entomopathogenic fungi most often occurs from contact of the fungal conidia with the host cuticle. This necessitates thorough coverage of the pests and foliage. Currently, the most widely used fungal insecticide is *Beauveria bassiana*. There are currently two registered fungal insecticides in the genus *Metarhizium*. *M. anisopliae* was one of the first fungi used in biological control experiments. Production of the Deuteromycetes is much less expensive [10].

They have a much broader host range and are able to grow and sporulate on many generalized media. They can adapt to a wide variety of growing conditions. This has made them the fungi most amenable to mass production. For descriptions of mass production of *B. bassiana, B. brongiartii, M. anisopliae,* and P.

Conclusion

The use of biological control in pest management systems has a long and rich history. While there is a variety of obstruction, there are so many opportunities for them to use as natural enemies in the management of insect-pests. Biological pest management tactics are important due to environmental and human safety concerns, development of insecticide-resistance, increases in pesticide cost etc. However, pesticides will likely remain a major component of IPM programs into the foreseeable future. Medications of pesticide use practices will also probably remain the most commonly implemented form of biological control in agricultural IPM. As IPM develop more ecologically based practice. Global climate change is beginning to affect agricultural systems worldwide and biological control practices may have to alter to adapt to these changes. Recent losses of conservation land and increased use of genetically modified crops and rising demand for organic produce IPM will have an important role to play, and the use of biological controls can be an integral part of IPM.

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