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ENVIRONMENTAL AND ECONOMIC BENEFITS OF BIOLOGICAL PEST CONTROL METHODS

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ABSTRACT:

Biological control is a way to manage insect pests and diseases without using harmful chemicals. Instead of spraying pesticides, this method relies on natural helpers, like certain insects, birds, or even bacteria, to keep pests in check. Many people like biological control because it is good for the environment and can be a smart choice for farmers and landowners. This approach not only helps protect crops and plants but also promotes a healthier ecosystem. By using natural control agents, we can reduce the negative effects of chemical pesticides on our planet while still effectively managing pest problems.

KEYWORDS:

HEAVY METALS, PRODUCTION AND USE, HUMAN EXPOSURE, TOXICITY, CARCINOGENICITY.

INTRODUCTION

Biological control is a natural phenomenon of plant and animal regulation by their natural enemies). Natural enemies of arthropods fall into three major categories: predators, parasitoids, and pathogens. The populations of natural enemies and their hosts and prey tend to maintain equilibrium in nature, and the population density of one group depends on the other's density. However, in agricultural systems, the characteristic of low vegetable diversity and the formation of temporary systems, such as in annual crops could be unfavorable for this equilibrium. Once this balance is broken, phytophagous insects and mites tend to reach high population densities, causing losses to the farmers. It aims at suppression of insect pests of crops or other harmful organisms by using their natural enemies (parasites, predators and pathogens). It constitutes a deliberate attempt to use natural enemies, either by introducing new species or by increasing the effectiveness of the same those present already in the environment (Sankaran, 1986). This technology is economically viable, of low environmental impact, and does not present risk so environmental contamination. It does not present risks for human health nor for domestic animals. Moreover, it presents great potential of use on the control of disease vectors, such as dengue fever and yellow fever, which abound in tropical regions throughout the world. Insect pest problems in agriculture have shown a considerable shift during first decade of twenty-first century due to ecosystem and technological changes. In India, the crop losses have declined from23.3 per cent in post-green revolution era to 17.5 per cent at present (Dhaliwal et al., 2010 (Altieri et al., 2005; Mahr et al., 2008). In India the earliest and successful introduction of a natural enemy against an insect pest was the coccinellid beetle Cryptolaemus montrouzieri (Muls.) from Australia in 1898 (Rao et al., 1971).

NATURAL ENEMIES OF INSECTS

PREDATORS

Predators catch and eat their prey. These are mainly free-living species that directly consume a large number of preys during their whole lifetime. As early as the late 1800s, lady beetles were being used in biological control programs in the United States (http://edis.ifas.ufl.edu). Ladybugs or lady beetles (Coleomegilla maculata) have been recognized by many cultures for their predatory behaviors for centuries. Some other common predatory arthropods include carabid (ground) beetles, staphylinid (rove) beetles, syrphid (hover) flies, lacewings, minute pirate bugs, nabid bugs, big-eyed bugs, and spiders. These insects are beneficial because they feed directly on other insects like aphids. Common predatory insects include lacewings, ladybugs, and praying mantids. Several insects and mites are predators during their whole life cycle. However, some insects do so only during the juvenile stage or during their adulthood. Adult and larvae feed on large numbers of small, soft-bodied insects such as aphids but they will also eat other small, soft-bodied insect larvae, insect eggs, and mites (www.gardeningsolutions.ifas.ufl.edu). Predators are basically chewers or suckers, but there can be combinations of these habits. In general, predators can be considered generalists in relation to their prey. There are exceptions, but one predator usually hunts the most abundant insects, the most easily captured and managed that they can find in any environment. One impressive strategy found in many sit-and-wait predators is crypsis, or camouflage. It serves to make the predator invisible to their own natural enemies, especially birds (which have excellent eye sight), and also to disguise themselves and not be perceived by their prey.

PARASITOID

The term parasitoid defines a behavior of host use that exists only in insects. Although the host can be a spider or even a snail, most of the parasitoid hosts are other insects. Parasitoids are insects that develop on or within their host. It is an insect whose larvae develop by feeding on the bodies of other arthropods; like a parasite they require just a single host to complete their development, but like a predator they invariably kill their host. The female parasitoid never builds a nest or cache, as do some related insects. Most parasitoids are wasps (Hymenoptera) or flies (Diptera). Example of egg parasitoid is Trichogramma Spp. It's used to control Corn borer (Ostrinia spp) in the farm, especially in developed countries like China and USA. Greater attention should be given to this parasitoid family in tropical regions, to increase its use in pest biological control programs

PATHOGEN

Pathogens are microorganisms including certain bacteria, fungi, nematodes, protozoa, and viruses that can infect and kill the host. Just as many other organisms get sick, so do insects. The main groups of insect disease-causing organisms are insect-parasitic bacteria, fungi, protozoa, viruses, and nematodes. Biological control using pathogens is often called microbial control. One very well-known microbial control agent that is available commercially is the bacterium Bacillus thuringiensis (Bt). While many species of bacteria, fungi, protozoa and nematodes inhabit bodies of insects establishing different levels of mutualistic relationships, only a limited number of them behave as insect pathogens. The latter have evolved a multiplicity of strategies to invade the host, to overcome its immune responses, to infect and to kill it. The application of microorganism for control of insect pests was proposed by notable early pioneers in invertebrate pathology such as Agostino Bassi, Louis Pasteur, and Elie Metchnik off (L. A. Lacey et al., 2001).The advantages of use of microbial control agents are numerous. These include safety for humans and other non target organisms, reduction of pesticide residues in food, preservation of other natural enemies, and increased biodiversity in managed ecosystems (R.R. Sharma, et al., 2009).

CONSERVATION OF NATURAL ENEMIES

It is absolutely essential if biological control is to work at all. This process involves manipulation of the environment to favor natural enemies, either by removing or mitigating adverse factors or by providing lacking requisites. Conservation of natural enemies works best in insect habitats which may lack only certain key requisites and it is with these habitats that adversity may be favorably modified for effectual action by natural enemies. In many cases, purchasing natural enemies to provide biological control agents is not necessary. Natural enemies are common and a grower can design production systems to attract and keep the natural enemies in the system by providing environmental conditions conducive to the enemies' survival. The goal is to create a suitable ecological infrastructure within the agricultural landscape to provide resources such as food for adult natural enemies, alternative prey or hosts, and shelter from adverse conditions. For example, many adult predators and parasitoids feed on nectar and pollen, so it is essential to have these resources nearby. Even pesticides allowed in organic production are insecticidal, and beneficial insects are often susceptible to the same pesticides used to control pest insects. If a pesticide must be used to control a pest outbreak, it should be applied in a manner to conserve beneficial insects.

INOCULATION AND INUNDATION

Inoculation is applicable where the problem is wide spread and the crop needs little insecticide against other pests. It involves releasing small numbers of natural enemies at prescribed intervals throughout the pest period. The natural enemies are expected to reproduce themselves to provide more long-term control. Many biological and microbial control agents are commercially available for purchase. Inundation involves releasing large numbers of natural enemies for immediate reduction of a damaging or near damaging pest population. It is a corrective measure; the expected outcome is immediate pest control. The applied organisms, which may or may not become established, can be used for relatively fast-acting, short-term control.

CONCLUSION

Recent surveys of both conventional and organic growers indicate an interest in using biocontrol products (19, 21), suggesting that the market potential of biocontrol products will increase in coming years. Increased demand for organic produce and participation in home gardening activities by pesticide-wary urban populations has enlarged the market for biocontrol products. The field of plant pathology will contribute substantially to making the 21st century the age of biotechnology by the development of innovative biocontrol strategies. Research on classical biological control of primary direct pests of these crops has been limited, although several outstanding successful cases of biological control have been reported (e.g., winter moth, woolly apple aphid, and others).In the future, a balance between research with conservation and augmentation of native natural enemies versus classical biological control studies of imported pests of these crops should be sought. Increase in crop production from the modern farming techniques reaching a plateau is the most of the countries including India and the environmental problems due to excessive use of chemical fertilizers and pesticides becoming a matter of concern. So, the biological control can be alternate system, which may play an important role in achieving the goal of agriculture.

REFERENCES

1. Abbasi PA, Al-Dahmani J, Sahin F, Hoitink HAJ, Miller SA. Effect of compost amendments on disease severity *and yield of tomato in conventional and organic production systems. Plant Dis. 2002; 86:156-161.*

2. Batson W, Caceres J, Benson M, Cubeta M, Brannen P, Kenny D et al. Evaluation of biological seed treatments for control of these edling disease complex of cotton. Biol. and Cult. Tests. 2000; 15:31-32.

3. Cook RJ, Baker KF. The Nature and Practice of Biological Control of Plant Pathogens. Amer. Phytopathol. Soc., St. Paul, Minnesota, 1983, 539.

4. Cook RJ, Weller DM. Management of take-all in consecutive crops of wheat or barley. In I. Chet (ed.). Innovative Approaches to Plant Disease Control. John Wiley& Sons, Inc, 1987, 41-76.

5. Costa AS, Muller GW. Tristeza control by cross protection: A U.S.-Brazil cooperative success. Plant Disease. 1980; 64:538-541.

6. De Bach P. ed. Biological Control of Insect Pests and Weeds. Reinhold, New York, New York, 1964, 844.

7. Waage J, Greathead DJ. Biological control: challenges and opportunities. In R. K. S. Wood and M. J. Way (eds.). Biological Control of Pests, Pathogens, a Weeds: Developments and Prospects. The Royal Soc., London, 1988.

8. Weller DM, Raaijmakers JM, McSpadden Gardener B, Thomashow LS. Microbial populations responsible for specific soil suppressiveness to plant pathogens. Ann. Rev. Phytopathol. In press, 2002.

9. Zhang W, Han DY, Dick WA, Davis KR, Hoitink HAJ. Compost and compost water extract-induced systemic acquired resistance in cucumber and Arabidopsis. Phytopathology. 1998; 88:450-455.