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Biopesticides

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Introduction

Despite the harmful implications involved in the use of synthetic chemicals to control pests, still they are extensively used in all countries all over the world. The increased social pressure to replace them gradually with other alternatives that are safe to humans and non-target organisms has led to increased development of compounds based on the models of naturally occurring active ingredients of biological origin, having various biological activities known as "biopesticides"

Biopesticides are broad array of microbial pesticides, biochemicals derived from micro- organisms, phytochemicals and other natural sources, and processes involves the genetic modification of plants to express genes encoding insecticidal toxins. The use of biopesticides for pest control today is an evolving field in pest management.

Biopesticides is a formulation made from naturally occuring substances that controls pests by non toxic mechanisms and in ecofriendly manner. Such as animals, plants, bacteria, and certain minerals. For example, canola oil and baking soda have pesticidal applications and areconsidered biopesticides.

Concept of Biopesticides

Bio-pesticides are naturally occurring substances from living organisms (natural enemies) or their products (microbial products, phytochemicals) or their by-products (semiochemicals) that can control pest by nontoxic mechanisms .Organization for Economic Co-operation and Devlopment (2009), viewed biopesticides as manufactured mass produced agents derived from natural sources living micro-organisms and sold for use to control pests. According to Suman and Dikshit , biopesticides encompass a abroad array of microbial pesticides, biochemicals obtained from micro-organisms and natural sources. Historically,

biopesticides has been associated with the biological control and by implication, the manipulation of livingorganisms as indicated.

Types of biopesticides

1. **Microbial pesticides:** These biopesticides are produced by microorganisms, including bacteria, viruses, and certain fungi. Each type of microbial pesticide targets a specific species or small group of species.E.g. **Bacillus thuringiensis*: is a natural occurring, soil-borne bacteria that has been used since the 1950s for natural insect control. It consists of a spore, which gives it persistence, and a protein crystal within the spore, which is toxic.
2. **Plant-Incorporated Protectants (PIPs):** These pesticides are produced from plants as a result of another genetically incorporated material added to that plant.
3. **Botanical pesticides**: These are naturally occuring plant material that crude preparation of the plants parts ground to produce a dust or powder that can be used in full strength or dilite form in a carrier such as clay. Azadirachtin effects the reproductive and digestive process of pest.
4. **Biochemical/herbal pesticides:** These are substances naturally occurring in the environment that control pests. This could include plant extracts that lure and trap insects or insect pheromones that interfere with mating.
5. **Semiochemicals:** A semiochemical by definition is a chemical signal produced by one organism, usually insects which caused a behavioural change in an individual of the same or different species.

Biopseticides formulations

In most cases, the active ingredients of biopesticides are formulated in the same way as the synthetic pesticides and most convenient for farmers to use the same equipment for application. The basis for most of the biopesticides is living organisms and their viability have to be maintained during the formulation process and stored at acceptable levels. The organisms must revive from their dormant state in order to be active at the application time. Final product is maintained by mixing the microbial

component with different carriers and adjuvants during formulation process for betterprotection from environmental factors.

Biopesticides dry formulations

- **Dustable powders**: Active ingredient concentration for dust formulations is usually 10% and is formulated by sorption of active ingredient on finely ground, solid mineral powder with particle size ranging from 50-100 mm. The inert ingredients for dust formulations are UV protectants, adhesive materials (i.e. stickers) to enhance adsorption and anticaking agent. Granules:Active ingredient concentration for granules ranges from 2-20% and the active ingredients either coat the outside of the granule or are absorbed into the granules.
- **Seed Dressing(SD):** A kind of biopesticide formulation obtained by mixing active ingredient carrier in form of powder and accompanying inert to facilitate end product adherence to seed coats. Powders for seed dressing are applied to seed by tumbling seeds with the product designed to adhere to them and they also contain colouring agents inform of red pigment as a safety maker for treated seed
- **Wettable powders**: These are also dry formulation ground finely and applied after suspension in water. Wettable Powders are obtained by blending active ingredients with melting and dispersing agents, synergist, surfactants, and inert fillers.

Liquid formulations

- **Emulsions**: Emulsion formulations are designed to be mixed with water and it couldbe normal emulsion which is oil in water (O/W) or an inert emulsion which is water inoil (W/O).
- **Suspension concentrate**: Formulated by mixing finely ground, solid active ingredient dispersed in liquid phase, usually water. Agitation is always a requisite before application to keep particles evenly distributed because the solid particles are not dissolved in liquid phase.

- **Oil dispersion**: The product of the formulation is produced in the same ways as suspension concentrate. Instability problems could be avoided by proper selection of inert ingredients.
- **Capsule suspension:** Active ingredients are formulated in micro-encapsulated stable suspension intended for dilution with water before use. Capsules made from gelation, starch, cellulose and other polymers are used to encapsulate the bioagents.

Ultra Low Volume Liquids (ULV): Formulations not intended to be diluted in water before use and have concentration of active ingredients. It is easy to transport and can be formulated using a suspended biocontrol agent as an active ingredient.

Biopesticides applications

Effective control of pests can be achieved by good selection of application techniques/methods and an appropriate time and/or frequency of biopesticides application.

- **Seed treatment**: One way to apply biopesticides is by seed treatment and is the most effective method or technique. Powder formulations are applied on seeds by tumbling seed with the product that is designed to adhere to the seed.
- **Foliar application:** Simply means biopesticides application on leaves surface as sprays. For example application of B. subtillis .
- **Seedling dipping:** This involves dipping roots of the seedlings in biopesticides suspension for some minutes or hours prior to transplanting. For example *Trichoderma spp.*

Biopesticides control

- **Antibiosis**: This occurs as a result of an interaction with other microbes mediated by specific metabolite of microbial origin, by volatile compounds, lytic enzymes or other toxic substances.
- **Competition**: Another mechanism of control by biopesticides is their ability to compete aggressively, that they grow rapidly.

- **Hyperparasitism**: Hyperparasitism is the lysis of the death by other microorganisms or direct parasitism. For e.g *T. lignorum*

Advantages of biopesticides

- More-renewable
- Biodegradable
- Can be more effective in the long-term
- Effective in small quantities and quickly decompose, avoiding pollution, which is a major problem with synthetic pesticides
- Biopesticides are usually inherently less harmful/toxic and cause less environmental load or pollutions.
- Designed to only one specific pest or, in some cases, a few target pests as opposed to chemical that have a broad spectrum activity.
- Cost of developing biopesticides is significantly lower than those of synthetic chemical pesticides.
- Their nature of control is preventive not curative and their effects on flower is less.

Disadvantages of biopesticides

- The very high specificity against the target disease and pathogen that may require multiple microbial pesticides to be used.
- Biopesticides are not suited for a stand-alone treatment rather they have to be with a compartible method for high efficacy.
- Living organisms evolve and increase their resistance to biological, chemical, physical and any other form of control.
- Because of their slow speed of action, biopesticides are often unsuitable if a pest outbreak is an immediate and becames a threat to crops.
- On the other hand predators and chemicals may be danger for other beneficial insects in threatened area.

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- Heat, desiccation (drying out), or exposure to ultraviolet radiation reduces theeffectiveness of several types of microbial insecticides.
- Special formulation and storage procedures are necessary for some microbial pesticides. .

Conclusion

The increasing concern of consumers at one hand, and government on the other hand about the problems associated with synthetic chemicals for pest control, and on food safety has led growers to find new eco-friendly methods to replace the current chemical-based practices. The use of biopesticides as supplement has emerged as promising alternative to chemical pesticides and their demand is rising steadily in all parts of the world. Therefore, this report has provided some information about the potentials of "biopesticides for pest control" and if fully exploited, could serve as a very effective alternative method for pest control.