



Bio-Pesticides and their Importance in Plant Protection

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Bio-pesticide is pesticides derived from naturally occurring sources, such as microorganisms, plants, animals and a few minerals. The 3 categories of bio-pesticides include microbial pesticides, plant-incorporated protectants and biochemical pesticides.

Need for Pest Control

Most ingredients for all of your favourite foods are grown by our essential workers the farmers. As you can imagine, the job of a farmer is NOT an easy one. They face many challenges, not the least of which is irregular weather conditions, loss of soil fertility, uncertain rainfall and of course, pests. Pests alone account for anywhere from 27 to 42 % of the total global crop loss that farmers face every year. To combat these pests, it has become the norm around the world for farmers to use pesticides. Pesticides are chemical compounds that repel or kill pests. These can fall into different categories, such as carbamates, organochlorines, organophosphates, and sulfonylurea. A common example of an organochlorine pesticide is DDT (Dichlorodiphenyltrichloroethane), which is used to kill insects. It was the extensive utilization of this pesticide during World War II that launched the era of chemical pesticides worldwide.

Problems with Pesticides

There are, however, numerous problems that arise from the use of such chemical pesticides. Environmental pollution is one such grave concern. Toxicity to humans who handle them is another major health hazard. There is growing concern over the chemical residue from pesticides in our food, which is increasingly being linked to various illnesses. To the farmer, the loss of soil fertility in the long run is perhaps the biggest drawback of using pesticide. However, this is countered in the short term by better crop yield. Thus, its use remains an ongoing dilemma for farmers.

Biopesticides: The Solution

Bio pesticides are naturally occurring pesticides derived from either plants, animals, microorganisms or minerals. They are non-toxic, naturally environmentally friendly and are a key ingredient in sustainable farming. Canola oil or baking soda is easily obtainable and commonly used as bio-pesticides for home gardens. Food security is of critical importance due to the world's growing population. The well-being of humans, as well as global economies, depends upon a stable and reliable food supply. As the population continues to grow, food security will only come under more threat in the future. Sustainable farming and maximizing soil fertility demands non-toxic and environmentally friendly pesticides. Thus, the need for bio-pesticides seems poised to grow with time.

Types of bio-pesticides

Bio-pesticides fall into 3 main categories:

1. Microbial pesticides
2. Plant-incorporated protectants
3. Biochemical pesticides

1. Microbial pesticides

Microbial pesticides are like security guards hired to protect crops (except they have no labor rights). They are microorganisms, such as viruses, bacteria or fungi that prey on the pests that cause harm to crops. The most common being the bacterium *Bacillus thuringiensis* (Bt). This bacterium produces a crystal protein that is toxic when eaten by pests, such as caterpillars, moths and worms, proving fatal to them.

What makes this protein as efficient as a pesticide is that these crystal proteins, also known as “Cry toxins” are inactive until they are consumed by the insects. Once ingested by the insect, the protein binds to receptors in the insect’s gut. Once bound to these receptors, it makes a hole in their guts, effectively killing them. Don’t worry though; this protein is harmless for humans. It does not prove toxic to us, as we don’t possess the receptors in our gut to which this protein binds, so it is an inactive compound outside of the pests that have receptors for them.

2. Plant-incorporated protectants

Plant-incorporated protectants (PIPs) are compounds that are toxic to pests, and are produced by plants that have been genetically modified. For example, the gene for the toxic protein produced by Bt is added to such plants, so that they also produce the same protein. This makes the plant toxic for the pests that try to eat it. Once again, the lack of matching receptors prevents any harm to humans from such plants.

3. Biochemical pesticides

Biochemical pesticides are herbal pesticides—naturally occurring chemicals that possess pest-repelling properties. Examples of biochemical pesticides include hydrogen peroxide (H₂O₂), plant oils like eucalyptus oil, lemongrass oil and rosemary oil. If a man-made compound is structurally similar to a naturally occurring compound, it is still considered a biochemical pesticide. An example is the biochemical pesticide methoprene. Methoprene is structurally similar to insect juvenile hormone (JH). Methoprene supplied as a pesticide in unnatural quantities mimics the function of JH and disrupts the biological cycle of the insect, thereby interfering with its development. While most biochemical pesticides have been used successfully, one problem with this category of bio-pesticides is that there isn’t sufficient scientific research conducted regarding their toxicity or safety.

Advantage of Bio-pesticides

- Host specificity.
- Ability to multiply in the target cells.
- No problem of toxic residue.
- No evidence or absence of resistance.
- No problem of cross resistance.
- Conventional technique or methods for applications.
- Permanent control of pest or long persisting effect.
- Ideally suited for integration with most other plant protection measures used in IPM programme.
- No fear of environment pollution and hence eco-friendly.

Disadvantages of Bio-pesticides

- High selectivity or host specificity.
- Requirement of additional control measures.
- The correct time of application.
- Delayed effect or mortality.
- Storage problem.
- Difficulty of culturing in large quantities
- Short residual effectiveness.