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Pest Control Through Biopesticides

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Abstract

The eco-friendly alternative to chemical pesticides is bio pesticides, which involves a series of disinfectant-based pesticides. Organic chemicals are derived from micro-organisms and other natural resources, and processes that involve genetic synthesis of DNA in agricultural products that provide protection against pests. Bio pesticides fall into three major categories. The interest in bio pesticides is based on the harmful effects associated with the chemical pesticides discussed. Global production of bio pesticides is over 3,000 tons / year, which is growing rapidly. India has great potential for bio pesticides. However, its acceptance by Indian farmers requires education to maximize profits. The market share of bio pesticides is only 2.5% of the total pesticide market. Pressure on organic farming and free commodity goods will ensure increased use of bio pesticide pesticides by farmers. Targeted pesticides targeted are considered safer compared to the unintentional objects that include humans. However, in India, the registration committee needs data on chemistry, bio-efficacy, toxicity and packaging and labelling, in order to be registered. The Pesticide Registration Committee has so far not approved any guidelines for the registration of GM pesticides. In India, other pesticides such as Bt, NPV, medicinal pesticides, etc. they are already registered and active.

Key words: Bio pesticides, Bt, organic farming, pesticide, pests

Introduction

Agriculture has had to face the destructive activities of numerous pests like fungi, weeds and insects from time immemorial, leading to radical decrease in yields. With the advent of chemical pesticides, this crisis was resolved to a great extent. But the over dependence on chemical pesticides and eventual uninhibited use of them has necessitated for alternatives mainly for environmental concerns. Degraded soils and groundwater pollution has resulted in nutritionally imbalanced and unproductive lands. Violative pesticide residues also sometimes raise food safety concerns among domestic consumers and pose trade

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impediments for export crops. Therefore, an eco-friendly alternative is the need of the hour. Biopesticides or biological pesticides based on pathogenic microorganisms specific to a target pest offer an ecologically sound and effective solution to pest problems. They pose less threat to the environment and to human health. The most commonly used biopesticides are living organisms, which are pathogenic for the pest of interest. These include bio-fungicides (*Trichoderma*), bioherbicides (*Phytopthora*) and bioinsecticides (*Bacillus thuringiensis*). The potential benefits to agriculture and public health programmes through the use of biopesticides are considerable.

The interest in biopesticides is based on the advantages associated with such products which are:

- Inherently less harmful and less environmental load
- Designed to affect only one specific pest or, in some cases, a few targets organisms
- Often effective in very small quantities and often decompose quickly, thereby resulting in lower exposures and largely avoiding the pollution problems
- When used as a component of Integrated Pest Management (IPM) programs, biopesticides can contribute greatly.

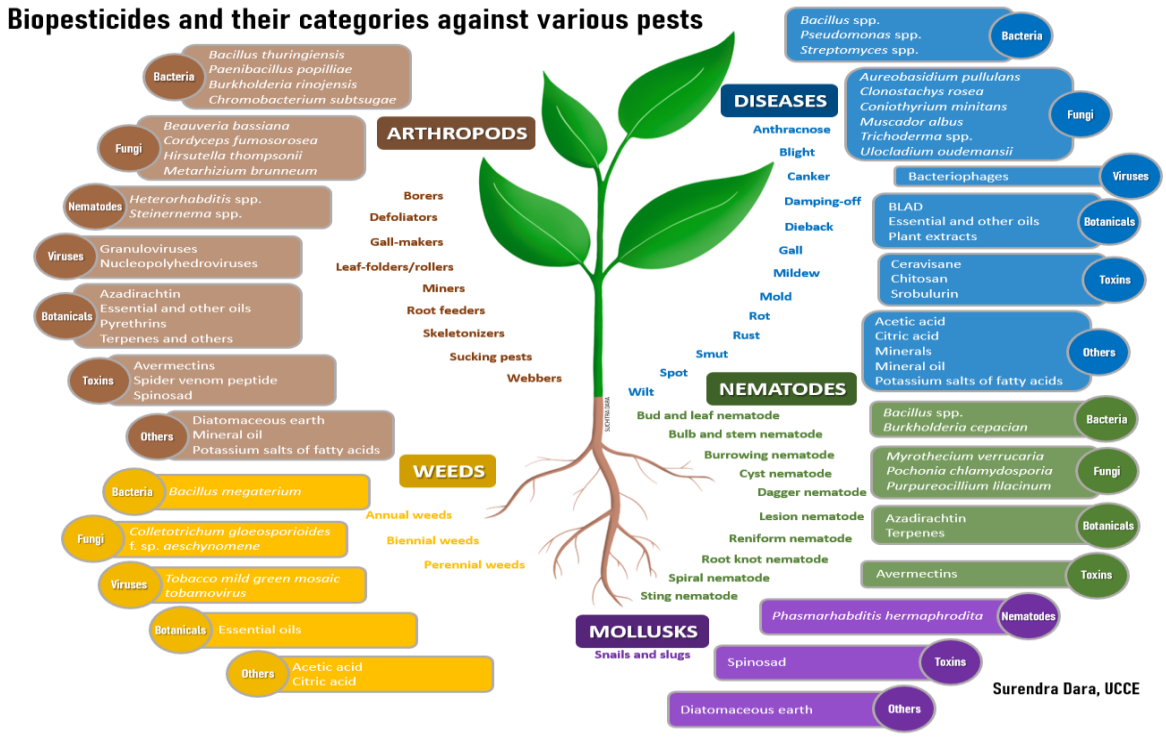

Fig.1 Various categories of bio-pesticides used in pest control (Dara, 2019)

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Biopesticides fall into three major categories (Fig 1.)

1. Microbial pesticides contain a microorganism (bacterium, fungus, virus, protozoan or alga) as the active ingredient. Microbial pesticides can control many different kinds of pests, although each separate active ingredient is relatively specific for its target pest[s]. For example, there are fungi that control certain weeds, and other fungi that kill specific insects. The most widely known microbial pesticides are varieties of the bacterium Bacillus thuringiensis, or Bt, which can control certain insects in cabbage, potatoes, and other crops. Bt produces a protein that is harmful to specific insect pests. Certain other microbial pesticides act by out-competing pest organisms. Microbial pesticides need to be continuously monitored to ensure they do not become capable of harming non-target organisms, including humans.
2. Plant-pesticides are pesticidal substances that plants produce from genetic material that has been added to the plant. For example, scientists can take the gene for the Bt pesticidal protein, and introduce the gene into the plants own genetic material. Then the plant, instead of the Btbacterium manufactures the substance that destroys the pest. Both the protein and its genetic material are regulated by EPA; the plant itself is not regulated.
3. Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Conventional pesticides, by contrast, are synthetic materials that usually kill or inactivate the pest.

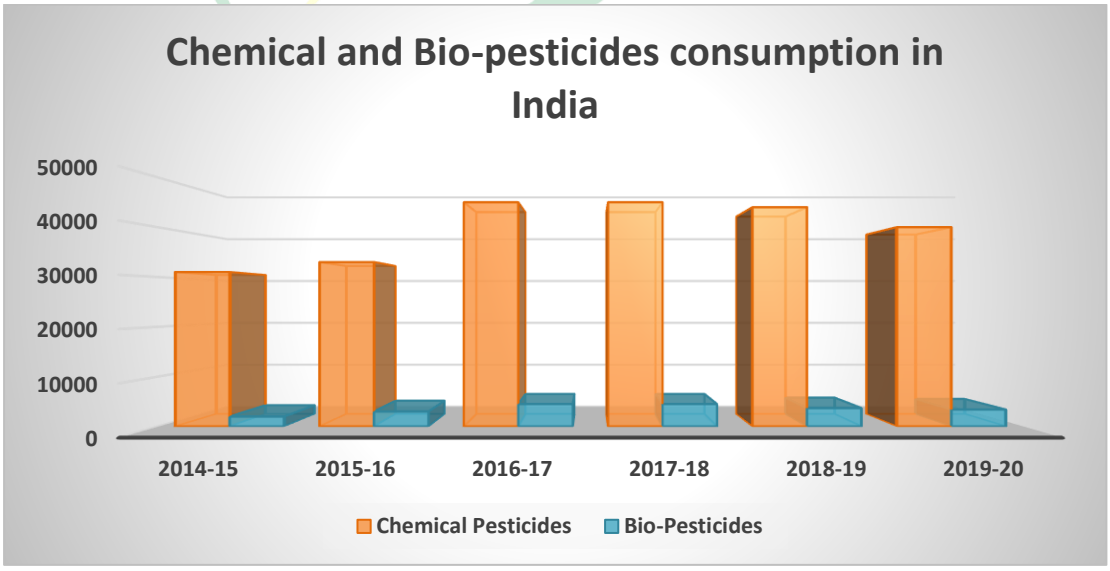

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Figure 1. Chemical and Bio-pesticides consumption in India during past 6 years

Biochemical pesticides include substances that interfere with growth or mating, such as plant growth regulators, or substances that repel or attract pests, such as pheromones. Because it is sometimes difficult to determine whether a natural pesticide controls the pest by a non-toxic mode of action, EPA has established a committee to determine whether a pesticide meets the criteria for a biochemical pesticide.

Major biopesticides produced and used in India are briefly described below:

Neem: Derived from the neem tree (*Azadirachta indica*), this contains a number of chemicals, including 'azadirachtin', which affect the reproductive process and the digestion of important insects. Recent research conducted in India and abroad has led to the development of the construction of neem, which is produced commercially. Since neem is not toxic to birds and mammals and is free of cancer, its demand may increase. However, the current demand is very small. Although more than 100 firms are registered to produce neem pesticides in India, only a few produce them.Additionally, very little of the production is sold nearby, most being for export markets.

Bacillus thuringiensis (Bt) is the most commonly used biopesticide globally. It is primarily a pathogen of lepidopterous pests like American bollworm in cotton and stem borers in rice. When consumed by pest larvae, Bt releases such toxins that damage the mid-gut of the pest and eventually killing it. Main sources for the production ofBT preparations are the strains of the subspecies *kurstaki, galeriae* and *dendrolimus.*

Baculoviruses are target specific viruses that can infect and abolish a number of important plant pests. They are particularly effective against the lepidopteran pests ofrice, cotton, fruits and vegetables. Their large-scale production stances certain difficulties, so their use is limited to small areas only. They are not available commercially in India, but are being produced on a small scale by various state agricultural departments and IPM centres.

Trichoderma is a fungicide i.e., effective against soil borne diseases such as root rot. It is particularly relevant for dryland crops such as groundnut, green gram,black gram and chickpea, which are susceptible to these diseases. *Trichogramma* are minute wasps which are exclusively egg-parasites. They lay eggs in the eggs of various lepidopteran pests. After

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hatching, the *Trichogramma* larvae feed on and destroy the host egg. *Trichogramma* is particularly effective against lepidopteran pests like the sugarcane internode borer, pink bollworm and sooted bollworms in cotton and the stem borers in rice. They are also used against vegetable and fruit pests. *Trichogramma* is the most widespread biocontrol agent in India, mainly because it kills the pest in the "egg stage", ensuring that the parasite is destroyed before any damage is done to the crop. *Trichogramma* eggs have to be used within a short period (before the eggs hatch). Some success stories about successful utilization of biopesticides and bio-control agents in Indian agriculture include (Kalra and Khanuja, 2007):

- Control of diamondback moths by Bacillus thuringiensis
- Control of mango hoppers and mealy bugs and coffee pod borer by Beauveria
- Control of *Helicoverpa* on cotton, pigeon-pea, and tomato by Bacillus thuringiensis
- Control of white fly on cotton by neem products
- Control of *Helicoverpa* on gram by N.P.V.
- Control of sugarcane borers by *Trichogramma*
- Control of rots and wilts in various crops by *Trichoderma*-based products.

Conclusion

The National Farmer Policy 2007 has strongly recommended the promotion of bio pesticides for increasing agricultural production, sustaining the health of farmers and environment. It also includes the clause that bio pesticides would be treated at par with chemical pesticides in terms of support and promotion. Global production and use of bio pesticides is increasing rapidly. The interest in organic farming and pesticide-free agricultural products could certainly justify the increased adoption of bio pesticides by farmers. Production training and quality control for producers, as well as organizational training for extension workers and farmers to become famous for pesticides may be essential for better adoption of this technology. As environmental protection is a global concern, we need to sensitize farmers, producers, government agencies, policy makers and ordinary men to switch to bio pesticides to meet pest control requirements. It is also believed that natural pesticides may be less susceptible to genetic diversity in plant species causing problems related to pest resistance. Used properly, bio pesticides have the potential to stabilize global agriculture for food security and food security.

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Future Perspectives: Further research and development of biological pest control measures should be prioritized and individuals and farmers in particular should be educated on the management and implementation of such control measures. All of this will lead to a common understanding of the benefits of biopesticides as an alternative to green. However, the need for the current situation is in IPM, INM, ICM and GAP and in doing so the quality of life and health will be guaranteed.

References:

Dara SK. 2019. The new integrated pest management paradigm for the modern age. Journal of Integrated Pest Management. 10:12.

GOI. 2020. Statistical Database | Directorate of Plant Protection, Quarantine & Storage | GOI. Retrieved from http://ppqs.gov.in/statistical-database.

Kalra Aand KhanujaSPS. 2007. Research and Development priorities for biopesticide and biofertiliser products for sustainable agriculture in India. In. Business Potential for Agricultural Biotechnology. Asian Productivity Organisation. 96:102.

Kumar S and Singh A.2015. Biopesticides: Present Status and the Future Prospects. Journal of Fertilizers and Pesticides. 6:129.