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# Biopesticides

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## Abstract

Bio-pesticides are ecofriendly pesticides which are obtained from naturally occuring substances(biochemicals), microbes and plants. Not all natural products are biopesticides. Some are chemical pesticides if they act on nervous system of the pest. Through the use of biopesticides in a wider way, agriculture and health programmes can be beneficially affected. There are many disadvantages associated with the use of chemical pesticides like genetic variations in plant populations, reduction of beneficial species, damage to the environment or water bodies,poisoning of food and health problems such as cancer which makes biopesticides to come into picture. Their usage reduces risk of exposure to chemicals, reduces water pollution through fertilizer runoff, reduces number of applications, causes less harm to beneficial pests, biodegradable, provides better nutritional quality. The total world production of biopesticides is over 3,000 tons/yr, which is increasing at a rapid rate. India has a vast potential for biopesticides. However, its adoption by farmers in India has to be motivated for maximizing gains. Some bio-pesticides currently being developed may be excellent alternatives to chemical pesticides. Also in India, there are many locally available plants like beshram, neem, garlic, triphala, pinus kesia etc which can be easily processed and increase the biopesticide consumption in India. However, in India, some of the biopesticides like Bt, NPV, neem based pesticides, Trichoderma etc. have already been registered and are being practiced. Through my paper, I would like to highlight role of biopesticides in agriculture and potential biopesticides availabile in India. Also,the establishment of biopesticide units in rural areas, where such plants are available, will also provide employment to the dwellers.
Keywords- Biopesticide;Bt;Trichoderma;NPV;Biodegradable

## 1. Introduction

Agriculture plays a vital role in a developing country like India. Apart from fulfilling the food requirement of the growing Indian population, it also plays a role in improving economy of the country. The Green Revolution technology adoption between 1960 to 2000 has increased wide varieties of agricultural crop yield per hectare which increased 12-13% food supply in developing countries. Southeast Asia and India were the first developing countries to show the impact of GR on varieties of rice yields. Inputs like fertilisers, pesticides helped a lot in this regard. But inspite of this fact, food insecurity and poverty still prevails prominantly in our country. Use of chemical biopesticides and fertilisers have caused negative impact on environment by affecting soil fertility,water hardness, development of insect resistance,genetic variation in plants, increase in toxic residue through food chain and animal feed thus increasing health problems and many more. This has made it essential to introduce measures which can harness foresaid challenges. Use of Biopesticides and Biofertilizers can play a major role in dealing with these challenges in a sustainable way. My focus in this paper will be on use of conventional biopesticides.

## 2. Pesticides and Environmental Safety

Biopesticides are biochemical pesticides that are naturally occurring substances that control pests by nontoxic mechanisms. Biopesticides are living organisms (natural enemies) or their products (phytochemicals, microbial products) or byproducts (semiochemicals) which can be used for the management of pests that are injurious to plants. 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 biofungicides (*Trichoderma*), bioherbicides (*Phytopthora*) and bioinsecticides (*Bacillus thuringiensis*). There are few plant products also which can now be used as a major biopesticide source. Plant-incorporated protectants include substances that are produced naturally on genetic modification of plants. Such examples are incorporation of Bt gene, protease inhibitor, lectines, chitinase etc into the plant genome so that the transgenic plant synthesizes its own substance that destroys the targeted pest. 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 somecases, a few target organisms,
- Often effective in very small quantities and often decompose quickly, thereby resulting in lower exposures and largely avoiding the pollution problems and
- When used as a component of Integrated Pest Management (IPM) programs, biopesticides can contribute greatly.

## 3. Biopesticides in India

Biopesticides represent only 2. 89% (as on 2005) of the overall pesticide market in India and is expected to increase drastically in coming years. In India, so far only 12 types of biopesticides have been registered under the Insecticide Act, 1968. Neem based pesticides, *Bacillus thuringensis*, NPV and *Trichoderma* are the major biopesticides produced and used in India. Whereas more than 190 synthetics are registered for use as chemical pesticides. Most of the biopesticides find use in public health, except a few that are used in agriculture. Besides, i) transgenic plants and ii) beneficial organisms called bio-agents: are used for pest management in India.

**Table 1:** Biopesticides registered as insecticides Act, 1968.

| S. No. | Name of the Biopesticide |
|---|---|
| 1. | Bacillus thuringiensis var. israelensis |
| 2. | Bacillus thuringiensis var. kurstaki |
| 3. | Bacillus thuringiensis var. galleriae |
| 4. | Bacillus sphaericus |
| 5. | Trichoderma viride |
| 6. | Trichoderma harzianum |
| 7. | Pseudomonas fluoresens |
| 8. | Beauveria bassiana |
| 9. | NPV of Helicoverpa armigera |
| 10. | NPV of Spodoptera litura |
| 11. | Neem based pesticides |
| 12. | Cymbopogan |

## 4. Adoption of Biopesticides Available from Plants

### 4. 1 Plant products

Use of botanicals is now emerging as one of the important means to be used in protection of crop produce and the environment from pesticidal pollution, which is a global problem.

**Table 2:** Plant products registered as biopesticides.

| Plant product used as bio-pesticide | Target pests |
|---|---|
| Limonene and Linalool | Fleas, aphids and mites,also kill fire ants, several types of flies, paper wasps and house crickets |
| Neem | A variety of sucking and chewing insect |
| Pyrethrum / Pyrethrins | Ants, aphids, roaches, fleas, flies, and ticks |

| | |
|---|---|
| Rotenone | Leaf-feeding insects, such as aphids, certain beetles (asparagus beetle, bean leaf beetle, Colorado potato beetle, cucumber beetle, flea beetle, strawberry leaf beetle, and others) and caterpillars, as well as fleas and lice on animals |
| Ryania | Caterpillars (European corn borer, corn earworm, and others) and thrips |
| Sabadilla | Squash bugs, harlequin bugs, thrips, caterpillars, leaf hoppers, and stink bugs |

Neem is regarded as the most effective and ecofriendly Neem products are effective against more than 350 species of arthropods, 12 species of nematodes, 15 species of fungi, three viruses, two species of snails and one crustace and species. Neem can be a very effective source in India where its production is an easy job**.**

**4. 2 Vrakshayurveda**

Vrakshayurveda is traditional Indian knowledge of plants like sowing techniques, plant propagation techniques including pest and disease management/preventive and promotive care to build up disease resistance and to cultivate healthy plants. Extracts of plants like neem, garlic, onion, persian lilac, turmeric, ginger, tobacco, papaya, leucas, pongam, tulasi, aloe, custard apple, vitex, sweetflag, poison nut, calotropis etc and their effects on curing plant diseases have been tested by "Centre for Indian Knowledge Systems, 30, Gandhi Mandapam Road, Kotturpuram,Chennai – 600 085. India. "

**Table 3:** Potential Biopesticides(from plant extract)

| **Plant extract** | **Effective against** |
|---|---|
| Adathoda kashayam and Pudhina kashayam | Leaf folder, bacterial leaf blight, Helminthosporium leaf spot |
| Thriphala kashayam | Bacterial leaf blight and Helmintho sporium leaf spot, |
| Andrographis kashayam and Sida kashayam | Aphids and borers in brinjal, ladies finger |
| Barley Sesamum Horsegram kashayam | Acts as fruit yield enhancer |
| Cow's urine arkam & Sweet flag arkam | Bacterial leaf blight, Helminthosporium leaf spot, vein clearing disease, fusarium wilt, |
| Garlic arkam | Leaf folder, bacterial leaf blight, Helminthosporium leaf spot |
| Neem seed extract(for all crops) | Leaf folder, aphids, Jassids, fruit borer and stem borer |

## 5. Limitations

Farmers are used to pesticides which are packaged and available from the shelf. Even though farmers realise the importance of using plant products as alternatives to chemical pesticides, the widespread use of these plant products will take a while to become very popular. One of the ways by which they can be popularised is to process it and make it available to the farmers in a readily usable form.

## 6. Conclusions

India's rich bio-diveristy is an ace factor, always providing a wide source of bio-pesticides which can be effectively used in agriculture at a large scale. Also increasing helth consciousness of Indian citizens have created a demand of organic food. This indicates huge scope for growth of Bio-pesticides sector. The rich traditional knowledge base available with the highly diverse indigenous communities in India may provide valuable clues for developing newer and effective biopesticide. The stress on organic farming and on residue free commodities would certainly warrant increased adoption of biopesticides by the farmers.

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