Green pesticides for clean environment

Safe environmental perspective

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***Abstract* - The trend for food safety and pest control in today's era is changing from conventional pesticidal use to use of biopesticides, also known as green pesticides, to save the environment from pesticidal pollution and human kind from possible health hazards due to harmful chemicals in conventional pesticides. The main aspects to develop the biopesticide are to identify, isolate, evaluate and use as biopesticide of the active ingredient of any biological organism or plant. Different methods are adopted to use these ecofriendly and safe compounds in agricultural system. These safe compounds of biological origin are the need of our system to save deteriorated environment and human health and also for organic agriculture.**

Keywords: Biopesticide, Green pesticides, Environmental pollution, Human health.

I. INTRODUCTION

Insect control constitutes a major and ancient preoccupation of human beings. Insects form the largest class of the animal kingdom and include nearly 80% of the known animal species. Among them, many species are considered as high risk species for man. They have double impact on humans as:

1. Medical**:** Insects are pathogenic agents or disease vectors for men and domestic animals.
2. Agricultural: They devastate crops.

Phytophagous insects damage remarkable amount of our major crops. Thus, the control of herbivorous insects still remains a great economic goal for a world population likely to double within the next 50 years. Therefore, over the last 30 years, the market for pest management products for crop protection has shown a regular growth of 7-10% per year, a turnover of around 25 billion US dollar. This growth has been accompanied by a deep reorganization of the industrial section, not only because of many takeovers and amalgamations of companies but also because of modification in number and nature of commercialized insecticidal molecules [1].

Recently uninterrupted and indiscriminate use of conventional insecticides in crop protection programs around the world has resulted in:

- ✓ Disturbance of environment.
- ✓ Pest resurgences.
- ✓ Pest resistance to conventional pesticides.
- ✓ Lethal effect to non target organisms.
- ✓ Fatal effects on humans and animals.

Therefore, it has now become necessary to search for the alternative means of pest control, which can minimize the risks of synthetic pesticides. Natural plant chemicals will undoubtedly play a significant role in the future of the pest control in both industrialized and developing countries. Because of the need for new, safer insecticides, there have been efforts to exploit the natural chemical defence mechanisms of plants [2]. Much of the research has focused on plant chemicals that specifically affect processes peculiar to the target pests.

Biopesticides are the important alternatives to minimize or replace the use of synthetic pesticides as they possess an array of properties including:

- ✓ Toxicity to the pest.
- ✓ Repellency.
- ✓ Antifeedance.
- ✓ Insect growth regulatory effects against pest of agricultural importance.

II. CONCEPT OF BIOPESTICIDES

Higher plants contain a wide spectrum of secondary metabolites such as phenols, flavonoids, quinones, tannins, essential oils, alkaloids, saponins and sterols. Such plant derived chemicals may be exploited for their different biological properties; Biological because of their natural origin and biodegradable and do not leave toxic residue or by products. Biopesticides are also known as "Green Pesticides". In this context of agricultural pest management, Biopesticides are best suited for use in organic food production in industrialized countries but can play a much greater role in the production and post harvest protection of food in developing countries.

Biopesticides have many advantages over conventional pesticides;

- ✓ Possess low mammalian toxicity thus constitute least or no health hazards and environmental pollution.
- ✓ There is practically no risk of developing pest resistance to these products, when used in natural forms.
- ✓ They cause fewer hazards to non target organisms.
- ✓ No adverse effect on plant growth, seed viability and cooking quality of grains.
- ✓ Less expensive and easily available because of their natural occurrence.

Some of the biopesticides like Neem, Bel, Senwar, Pyrenthrum, Tobacco, Karanj, Mahua and Sweet flag etc. have already attained the status of potential pesticides of biological origin. Future of these ecofriendly and biosafe pesticides in agriculture can be emphasized in following main steps

1. Identification of biological organism and plants for biopesticidal properties.
2. Isolation, identification and evaluation of the active components of products.
3. Synthesis of the ecofriendly components for commercial use.
4. Use of developed biopesticides in pest management. It can be attained by:
5. Direct spray applications for control of Aphids, Jassids and Caterpillars.
6. Soil amendments for control of soil inhabiting pests like Grubs and Nematodes.
7. Intercropping / mixed cropping of bioactive plants / crops with main crop to maintain pest infestation.
8. For grain protectant against stored grain pests.
9. Use of biopesticides as synergistsbinders for conventional pesticides to enhance bioactivity of these pesticides [3, 4, 5].

III. BIOPESTICIDES OF PLANT ORIGIN

Biopesticides based on plant origin are the most common type of these pesticides. There are many plant species from several families which show bioactivity against insect pests.

Following tables quote some examples of plants along with their parts used as biopesticides (Table 1) and some commercially used formulations of biopesticides (Table 2) [6].

Table 1. Data of some plants used as biopesticides.

S. No.	Scientific name	Family	Parts used
1.	Adathoda vasica (Ness.)	Acanthaceae	Aerial parts
2.	Cynodon dactylon (Linn.)	Poaceae	Aerial parts
3.	Eclipta alba Linn.	Asteraceae	Aerial parts
4.	Morinda pubescens	Rubiaceae	Aerial parts
	J.E.Smith		
5.	Ocimum tenuiflorum (Linn.)	Labiatae	Aerial parts
6.	Phyllanthus amarus Linn.	Euphorbiaceae	Aerial parts
7.	Sesbania grandiflora (Linn.)	Fabaceae	Aerial parts
8.	Solanum trilobatum (Linn)	Solanaceae	Aerial parts
9.	Solanum surattense Linn.	Solanaceae	Aerial parts
10.	Vinca rosea Linn.	Apocyunaceae	Aerial parts
11.	Achillea ptarmica L	Asteraceae	flowering leaves & flowers
12.	Ambrosia artenisiifolia L.	Asteraceae	flowering leaves & flowers
13.	Artemisia vulgaris L.	Asteraceae	pre-flowering leaves & buds
14.	Cnicus benedictus L.	Lamiaceae	pre-flowering aerial parts
15.	Hyssopus officinalis L.	Lamiaceae	flowering aerial parts
16.	Marrubium vulgare L.	Lamiaceae	flowering leaves
17.	Melilotus officinalis (L.)	Fabaceae	flowering leaves & flowers
18.	Melissa officinalis L	Lamiaceae	flowering leaves & flowers
19.	Mentha virescence L.	Lamiaceae	flowering leaves & flowers
20.	Ocimum basilicum L.	Lamiaceae	flowering leaves & flowers
21.	Origanum majorana L.	Lamiaceae	vegetative aerial parts
22.	Picea excelsa L.	Pinaceae	vegetative needles &
			branches
23.	Pinus silvestris L.	Pinaceae	vegetative needles &
			branches
24.	Salvia officinalis L.	Lamiaceae	flowering leaves & flowers
25.	Salvia splendens SELLOW	Lamiaceae	flowering leaves & flowers
26.	Sanguisorba officinalis L.	Rosaceae	flowering leaves & flowers
27.	Taraxacum officinale Weber	Asteraceae	flowering leaves & flowers
28.	Veronica officinalis L.	Scrophulariaceae	flowering leaves & flowers

Table 2. Some commercial biopesticides and their formulations.

Product	Ingredient(s) and formulations
Neem Aura	Aloe vera, extract of barberry, camomile, goldenseal, myrrh, neem, and
	thyme; oil of anise, cedarwood, citronella, coconut, lavender,
	lemongrass, neem, orange, rhodiumwood, NeemAura Naturals, Inc.,
	Alachua, FL
GonE!	Aloe vera, camphor, menthol, oils of eucalyptus, lavender, rosemary,
	sage, and soybean, Aubrey Organics, Tampa, FL
SunSwat	Oils of bay, cedarwood, citronella, goldenseal, juniper, lavender, lemon
	peel, patchouli, pennyroyal, tansy,tea tree, and vetivert, Kiss My Face
	Corp., Gardiner, NY
Natrapel	Citronella (10%), Tender Corp., Littleton, NH
Bygone	Oils of canola, eucalyptus, peppermint, rosemary, and sweet birch,
	Lakon Herbals, Inc., Montpelier, VT
Bite Blocker	Glycerin, lecithin, vanillin, oils of coconut, geranium, and soybean (2%),
	Consep, Inc., Bend, OR
Skinsations	Deet (N,N-diethyl-3-methylbenzamide, 7%), Spectrum Corp., St. Louis,
	MO Spray
Repel	Lemon eucalyptus insect repellent lotion. Oil of lemon eucalyptus (65%
	p-menthane-3,8-diol [PMD]) (26%), Wisconsin Pharmacol Comp., Inc.,
	Jackson, WI
MosquitoSafe	Geraniol 25%, mineral oil 74%, Aloe vera 1%, Naturale, Ltd., Great
	Neck, NY
Nimbicidine	Neem seed kernel extracts

IV. CONCLUSION

The biopesticides are the most beneficial in insect pest control in context to economic considerations and potential health benefits of these. There are reasonable evidences to suggest that, with few exceptions, biopesticides pose no greater risk to human health then conventional insecticides and indeed are probably of substantially lower risk. Moreover, indigenous knowledge often extends beyond the potential efficacy of endemic plant crop protectant to include their toxicity to users.

So, the need of the hour is to change or at least modify the mode of pesticidal development at researchers and industrialists level to form biological, ecofriendly, biosafe and cost effective safe biopesticides to minimize the harmful effects of conventional pesticides and also to maintain or increase the crop yield to meet the continuously increasing grain demand for our expanding population.

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