

ROLE OF BOTANICALS IN PEST MANAGEMENT-CURRENT AND FUTURE PROSPECTIVES

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Abstract

Humans discovered the use of plants as pesticides after realizing that certain plants were better at protecting themselves than others. In the past, botanicals were employed prior to other types of insecticides. Chinese, Greek, and Roman antiquity all make reference to them, as does India, where the Veda, a collection of writings written in ancient Sanskrit that stretch back at least 4,000 years, mentions the usage of the neem tree (*Azadirachta indica* Juss.; Meliaceae). Therefore, it is challenging to pinpoint the precise location and timing of the systematic use of plants or plant extracts in plant protection or, more broadly, in agriculture. Although the process of discovering botanical pesticides is more laborious than that of their synthetic counterparts, the reduced environmental impact of botanical pesticides makes them a desirable substitute.

Keywords: Botanicals, Pest Management, Neem, Nicotine, Pyrethrum.

Introduction

As a secondary metabolites of plants, Botanicals provide a desirable and persuasive alternative for pest control. The fact that plant secondary metabolites play a role in interactions with other species, particularly in the defense response of plants against pests, is further supported by documented scientific literature. It may be possible to forecast which pests secondary metabolites originating from a specific plant species may be able to control by noticing which pests a given plant is being resistant. Many commercial pesticides, including pyrethroid insecticides, have been discovered as a result of this strategy. Several Herbicides, insecticides, fungicides, nematicides, molluscicides, and rodenticides are examples of botanicals. Some have direct toxicant and sterilant properties, while others have antifeedant/repellent or behavior-modifying properties.

Botanical Insecticide

Many plants produce compounds that are poisonous to insects as a form of self-defense. Accordingly, an extensive supply of chemical structures with pesticidal activity can be found in the secondary chemicals known as botanicals or botanical insecticides since they are produced from plants. Botanical insecticides were widely employed worldwide to combat insect pests before World War II.

Classification of Botanical Insecticide

Based on their impact on insects, Jacobson classified the plant components into six groups:

- * Repellents
- * Growth retardants
- * Toxicants
- * Chemosterilants
- * Feeding deterrents/antifeedants
- * Attractants.

Repellents:

By activating olfactory or other sensors, repellents keep insect pests away from treated materials. After 10

days of treatment at concentrations of 0.1 mg – 1 ml and higher, two historically valuable Ghanaian plant materials, *Ocimumviride* and *Chromolaenaodorata* decreased the survival of stored product insect pests to less than 25%.

Antifeedants/Feeding Deterrents: Chemicals known as “Antifeedants” or “feeding deterrents” prevent or impact with insect feeding by making the treated materials unappealing or unpalatable. The majority of naturally occurring antifeedants are triterpenehemiacetal, hydroxylated steroid meliantriol, aromatic steroids, glycosides of steroidal alkaloids and others. Alkaloids, phenolics, and terpenoids were the most powerful secondary metabolites that are used to make antifeedants. Limonoids from the neem (*Azadirachta indica*) and chinaberry (*Meliaazedarach*) trees, toosendanin, as well as limonin from citrus species, are the most common anti-feedants. The furanocoumarins and neolignans are the most well-known antifeedants among plant phenolics. The anti-feedants are very efficient which have rapid environmental degradation and potential desensitization of pests.

Toxicants: Essential oil toxicity depends on a number of factors, including the oil's chemical makeup, the source, the time of year, the environment, the extraction technique, and the plant component used. In insects that were preserved in products, the essential oil of *C. sativum* showed volatile toxicity. *Nicotianatabacum*'s main ingredient, nicotine, has been described as a potent organic toxin with insecticidal and contact-stomach effects that is also dangerous to humans. It has been found that numerous *Ocimum* species, as well as their oils, extracts, and bioactive components, exhibit insecticidal properties against a variety of insect species.

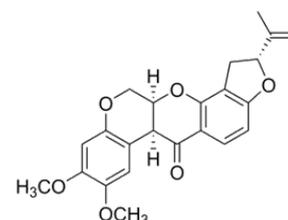
Chemosterilants/Reproduction Inhibitors: Insect oviposition, egg hatchability, postembryonic development, and progeny production have all been demonstrated to be impacted by the addition of plants and their various parts to grains. In female insects, botanicals cause the ovariole to malfunction. Oviposition inhibition occurs when a live female fails to lay her eggs or when a female dies before laying her eggs after coming into contact with botanical items.

Recent Developments in Botanical Insecticides

Pyrethrum: Dry flowers of *Chrysanthemum* spp. from the Asteraceae family are the key products of pyrethrum powder. Pyrethrum is also present in significant amounts in several *Chrysanthemum* species, including *C. roseum*, *C. tamrutense*, and *C. carneum*. Six esters make up pyrethrum, including the most prominent pyrethrins I and II, cinerin I and II, and jasmoline I and II .

Pyrethroids: Synthetic substances of pyrethrum are called pyrethroids but they are far more persistent and dangerous than Pyrethrum. They attach to leaf surfaces for weeks without being broken down by sunlight, killing any insects that try to avoid them. Pyrethroids can be effective insecticides, but they can also have negative consequences by irritating human skin. Some of them are highly harmful to fish, honey bees, and other natural enemies.

Rotenone: Among the frequently used botanical insecticides, rotenone is the most poisonous one. It comes from the roots of two tropical legumes, *Dorris* and *Lonchocarpus*. Rotenone poisons insects' stomachs and inhibits cell respiratory enzymes .



Nicotine : Most typically found as nicotine sulfate, nicotine is a naturally occurring pesticide derived from the stems and leaves of *Nicotiana* spp. (tobacco). It is extremely poisonous to mammals and a fast-acting nerve toxin. In insects, nicotine interacts with their nervous system to cause the heartbeat to increase at low dosages while reducing at high levels. In greenhouses, nicotine is often used as a fumigant to ward off soft-bodied insects. However, this issue will be sorted out by the production of stable nicotine fatty acid soaps, which are likely to have lower bioavailability and toxicity to humans

Constraints

- * Many of these products are only insect deterrents with a slow-acting impact, thus they are not really insecticides.
- * UV light quickly breaks them down, resulting in a brief lingering effect.
- * Plant pesticides are not always less harmful to other animals than synthetic ones.
- * They may not always be accessible during the season.
- * The majority of them lack known limits for residues.
- * Legal registrations proving their use do not exist.
- * Not every suggestion made by farmers has been validated by science.

Future use of Botanicals : Although pesticides tend to control the growth of individual pests and the reproduction of populations, the majority of active ingredients found in registered botanical pesticides and their mechanisms of action against pests are still unclear. Current research methods primarily refer to the methods used in chemical-pesticide research and take insect death rate within a certain period as the indicator of effective control.

Conclusion

The annoyance caused by the artificial insecticides will be eliminated by application of plants. Research is urgently needed in areas including stability modification, insect resistance avoidance through the creation of various innovative formulations, and alternate applications. In order to create sustainable agriculture in the near future, legislators' careful guidance to regulatory agencies will undoubtedly open the door for the simple manufacture and improved commercialization of botanical pesticides.

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